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CONTENTS

DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with every copy of this week's issue

Holidays with Pay

THERE was a further important development on the question of holidays with pay when the Minister of Labour stated in the House of Commons on June 2 that the Government desired to give effect, to the fullest practicable extent, to the recommendations of the Committee on Holidays with Pay. The Minister announced his intention to introduce a Bill empowering trade boards and agricultural wages committees to provide holidays with pay, and said that if there was a general desire to facilitate the passage of the Bill, as a non-contentious measure, it was hoped to pass it into law during the present session. A standing inter-departmental committee, and a special branch of the Ministry of Labour, are to be set up to deal with some of the recommendations of the Amulree Committee which do not require legislation, such, for example, as those for encouraging voluntary agreements for holidays with pay and for stimulating the co-ordination of industrial, educational, transport, lodging, and other holiday arrangements, which is essential if workers are to be enabled to take proper advantage of their holidays. The Minister of Labour stated that while the committee's recommendations with regard to the fixing of the Easter holiday will be borne in mind, there is no immediate prospect of being able to give effect to them.

Railway Racing

A recent article in *The Times* recalled that it is just 50 years ago that the railway race to Scotland was begun, by the action of the West Coast companies on June 1, 1888, in reducing their time between the English and Scottish capitals to nine hours, corresponding to that of their East Coast rivals. The keen public interest in the subsequent contests both to Edinburgh (in 1888) and Aberdeen (in 1895), was no artificial product of a newspaper stunt, but a natural accompaniment to the determination with which the competition was kept up by the railways themselves. Sir Henry Oakley, General Manager of the Great Northern Railway, writing to the North British General Manager, Mr. J. Conacher, well expressed the spirit of the time in the words, " Only a stern resolve to show them (*i.e.*, the West Coast companies) always that we are neither to be cajoled nor outrun will keep them quiet. I suggest therefore that we propose nothing and agree to nothing." So long as the rival railways wrested away no traffic, Sir Henry in the same letter suggested that they should be treated as " harmless, though restive, children." Mr. Conacher was equally in earnest. " My Chairman's opinion," he wrote, " is that the best policy is to beat the West Coast at any cost, and having done it proceed to remonstrate."

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The Week's Traffics

Whitsuntide holiday bookings for the Friday, Saturday, and Sunday on the L.M.S.R., Great Western, and Southern, and for the Friday and Saturday on the L.N.E.R., account for the passenger train increases shown last week in comparison with an ordinary week in 1937. For the same reason goods and coal receipts are down. The corresponding traffics of 1937 for the first part of the Whitsuntide holiday had also the benefit of Coronation travel and the London bus strike, and this year's holiday receipts from passengers show, in comparison, an increase of £12,000 on the L.M.S.R., but decreases of £1,000, £7,000, and £9,000 respectively on the L.N.E.R., Great Western, and Southern. In merchandise this year's Whitsuntide figures show a combined increase of £85,500 in comparison with Whitsuntide, 1937, but it must be remembered that most normal freight services were suspended on Coronation day in 1937.

	22nd Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 163,000	− 80,000	− 12,000	+ 71,000	− 443,000	− 1·67
L.N.E.R. ..	+ 61,000	− 40,000	− 39,000	− 18,000	− 308,000	− 1·58
G.W.R. ..	+ 54,000	− 22,000	− 14,000	+ 18,000	− 91,000	− 0·83
S.R.	+ 54,000	− 4,500	− 2,500	+ 47,000	− 82,000	− 0·98

London Transport receipts for the past week amounted to £582,400, a decrease of £2,700 on the corresponding week last year. For the 49 weeks to date the total is £27,617,800, an increase of £596,500.

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Bull and Bush Station, London

A recent traffic circular of the London Passenger Transport Board contained a notice that " until further notice, staff of the Permanent Way Department will make inspections twice daily of the hoardings erected at the site of the Bull and Bush disused station." Actually the word " disused " is somewhat of an overstatement, for the station which is commonly referred to by the name of the tavern immortalised by the music hall was never completed, and never actually served a single passenger. This site is between Hampstead and Golders Green on the Northern Line tube shortly before northbound trains emerge from the tunnel, but, excepting to regular passengers who have taken the trouble to make inquiries about

the change of noise which may easily be noticed, the fact that a station was projected at this point has been almost forgotten for the past thirty years. When the course of this line was selected in 1905, the projectors traversing the route in a hansom cab decided that a point immediately below the Bull and Bush tavern on the fringe of Hampstead Heath would make a suitable site for the last station in tunnel. The work was duly taken in hand, the platforms erected, and stairs to the lift shaft built. The lift shaft itself, however, was never sunk, and today no trace of the presence of a station is visible above ground. At the present time the site is being used for the storage of silencing screens for tube tunnels, and this explains the paragraph in the traffic circular.

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Jamaica Government Railway

The report of the Jamaica Government Railway for the year ended March 31, 1937, records some improvement in banana traffic, but the falling off continued in both passenger and other goods traffic, owing to road competition. Rates had to be reduced and under these conditions no improvement was expected in receipts. Acknowledgement is made of the valuable assistance rendered to the Railway Department by the Railway Advisory Board. Principal operating statistics were as follow:—

	1936–37	1935–36
Passengers	382,134	427,407
Goods, tons	303,468	274,900
Train-miles	410,852	409,434
Operating ratio, per cent.	98·37	102·45
	£	£
Coaching receipts	31,190	33,975
Goods traffic receipts	216,083	201,685
Gross receipts	279,384	264,249
Expenditure including renewals	274,839	270,744
Working profit(+) or loss (—)	+ 4,545	— 6,495

Total debt charges on the railway amounted to £90,144, and as the amount available from receipts was only £4,545, a balance of £85,599 remained to be met from General Revenue. The expenditure included £11,358 in respect of renewals, depreciation, and betterments, and £14,155 for flood damage. Additional expenditure was also incurred on account of regrading of salaries. The length of line remained at 210 miles, on the standard gauge.

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The International Rail Assembly

A reminder of the growing importance attached by rail-users and rail-makers to the composition and physical characteristics of rail steel is furnished by the announcement of the fourth International Rail Assembly, which this year is to take place at Düsseldorf from September 19 to 23. Among the 25 papers that have already been prepared, no fewer than eight deal with various aspects of welding, and two others with the risks of buckling on continuously welded track. Other writers are concerned with the question of ascertaining the potential wearing capacity of steel, for which no fully satisfactory test has yet been evolved, and with the general question of acceptance tests for rails; lessons learned from notched bar impact tests on rails that have fractured in service and from rail failures in general will also come under review. Other subjects include the important matter of corrosion, which has a considerable influence on rail life, especially in tunnels. Fourteen of the papers have been written by German engineers, five by Swiss, four by Hungarian, and one each by Polish and American engineers; but it is unfortunate that there appears to be no representation of the wide knowledge that exists in Great Britain on the steel rail, nor that of France. A feature of the Rail Assembly will be visits to most of the German works at which steel rails are made.

International Container Week

The four British main-line railways will be represented at the Third International Container Week, which, as recorded in our issue of May 20, is to be held in Brussels from June 13 to 17. The object of the week, at which Belgium, France, Italy, and Germany will be represented, in addition to other Continental countries, is to promote a complete exchange of ideas between container builders, transport undertakings, and others; to discuss problems affecting container transport; and to provide an opportunity for members of the International Container Bureau to inspect the various types of containers in service in other countries, their use, construction, methods of handling, equipment, and the latest developments. The British railways, which were the first in Europe to adopt containers, are sending nine containers, each complete with a rail chassis and securing devices, together with a six-ton mechanical horse and trailer to demonstrate the method of collection and delivery of containers in this country. The nine containers will include types used for the conveyance of furniture, bicycles, eggs (of which nearly 50,000 can be conveyed in 276 cardboard cartons in one container), meat, fish, and so on. The extent to which the use of road-rail containers has advanced in Great Britain in recent years can be judged from the fact that the stock has risen from 1,574 in 1928 to upwards of 13,800 at the present time. Further, figures of container movements in 1934 showed an increase of 700 per cent. over 1928, while the 1937 figures show a further increase of 41 per cent. over the 1934 total.

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Wooden Roofs for Railway Purposes

Few travellers passing through Copenhagen can fail to be impressed with the fine concourse of the Central station of which we give a brief description in this issue. One of the remarkable features of this building which, however, probably escapes the attention of most, is the fact that the roof is of timber. Such a lofty edifice is usually associated with steel construction, but wood has many advantages and has been largely used, especially in the Scandinavian countries, for the roofs of railway buildings. Unless constantly repainted steel structures are apt to suffer much from corrosion caused by smoke and steam which have little deleterious effect on timber. In 1912 the Swiss Federal Railways administration issued a circular to its various departments recommending the use of wood construction for railway purposes and citing as successful examples the then new engine sheds at Berne and the Central station at Copenhagen. The main roof as well as the platform umbrella roofs of the Central station at Stockholm are of timber, and timber is the material generally used in Sweden for such structures. At Stuttgart the platform roofing of the fine modern station of the Reichsbahn is of timber, supported on concrete columns.

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By Paris Metro to the Outer Suburbs

Although from 1857 until January 18 of the present year the lines from Paris (Luxembourg) to Sceaux-Robinson, and Limours were worked by the Paris-Orleans Railway, they were connected with the rest of that company's system only by a shuttle service between Massy-Verrières, and Orly. This isolation arose out of their development from an independent 5-ft. 9-in. gauge line opened between Sceaux and Denfert-Rochereau, *via* Bourg-la-Reine, in 1846. The P.O. Railway took the line over in 1857 and proceeded to extend southwards from Bourg-la-Reine, through Massy-Palaiseau, to Limours (reached in

1867). Conversion of these lines to standard gauge followed in 1883, and the extension in tunnel from Denfert-Rochereau to the Luxembourg terminus in 1895. In accordance with an Act of April 10, 1932, the P.O. Company, having electrified the lines as far as Sceaux-Robinson, and Massy-Palaiseau, transferred these portions on January 18 last to the Department of the Seine, on behalf of which they are now worked by the Metropolitan. An article describing these changes in the June issue of the *Revue Générale des Chemins de Fer* states that goods traffic is still worked over these routes as far into Paris as Denfert-Rochereau, hauled by new Metro electric locomotives.

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Vehicles on Curves

The present tendency to shorten journey times has drawn attention to the problem of ensuring smooth running at the considerably higher speeds at which many trains now travel, and the article we publish on page 1112 of this issue therefore assumes a topical importance. It has a dual objective; first, to show how by a comparatively simple mechanical device the relative movement and position of wheel and rail can be measured, and secondly to indicate the use of the device in testing to what extent any design of special radial movement intended to facilitate the smooth passage of vehicles round curves is actually fulfilling its purpose. Further, on the basis of the results revealed by the measurements, an ingenious axle-guiding device has been perfected. It is true that the mechanical measuring device has been used only for the comparatively low speeds of up to 25 m.p.h., but it seems reasonable to suppose that the results of such measurement could be applied effectively for vehicles designed to run at much higher speeds. In fact bogies with two guiding radial axles have been designed and actually constructed for high-speed articulated electric units on the same Swiss railway as that owning the railcar described in the article.

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A.T.C. on G.W.R. without Engine Battery

The automatic train control apparatus hitherto used on the great majority of G.W.R. locomotives includes a normally energised electro-magnet fed from a local battery and used to hold closed a valve in the train pipe inlet; the circuit is opened by a switch when the shoe passes over a ramp, and allows the electro-magnet to release its armature unless a current is picked up, in which case a polarised relay is operated and the effect of the opening of the shoe switch nullified. This, of course, occurs when the distant signal is "off" and the ramp energised. By the use of the modified equipment described on page 1106, the battery on the locomotive is eliminated, and the warning action is produced by direct mechanical drive between shoe and cab mechanism; the "line clear" bell is also rung by this agency through a striker device held in gear if current is picked up from the ramp.

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Electrification and High Speed

The article entitled "World Railway Speeds in 1937," which appeared in the February 4 issue of THE RAILWAY GAZETTE, drew attention to the major share played by electrification in producing the high-speed mileage of the Pennsylvania Railroad of America, which has a greater mileage of runs booked at 60 m.p.h. and over than any other railway in the world. It was pointed out that this enterprising company had exploited to the full the speed possibilities of electrification, practically the whole of its dense electric service between New York, Philadelphia, Baltimore, and Washington being booked, over short runs as well as long, at speeds of more than a mile-a-minute from start to stop, and up to a maximum of 71·3 m.p.h. Particulars given in an article which appears on page 1103 of this issue show that the streamlined 2-C_0-C_0-2 electric locomotives used on this service are capable of hauling trains composed of ordinary non-streamlined stock, up to 1,000 tons in weight, at sustained speeds of 80 m.p.h. and upwards over long distances continuously. The normal running is, indeed, of a description considerably more remarkable than the timings might indicate; it is the customary practice to make each stop with several minutes in hand, and punctuality is exemplary. The Pennsylvania is to be congratulated on having put its comprehensive and costly electrification scheme to such full speed use.

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Railway Welding in the U.S.A.

Our American contemporary, the *Railway Mechanical Engineer,* called attention in a recent issue to the considerable advances made in the U.S.A. in the application of welding for the construction of locomotives and rolling stock. This, together with the use of high-tensile steel and careful distribution of metal in the underframes and bodies, has permitted considerable reductions in the tare weight of vehicles. In many recent locomotives welding has been used extensively in construction of the firebox, cumbustion chamber, and barrel sections, and one experimental locomotive boiler on the Delaware & Hudson Railroad is welded throughout. This last example, however, is a somewhat bold departure from general practice and opinion on the subject. Taking results as a whole, the soundness of the principle of welding has been established, and although the coated electrodes used cost more per lb. than bare wire, their sales in America have increased in volume approximately 700 per cent. since 1933. Engineers in charge of design and maintenance of locomotives and rolling stock have been quick to realise the saving effected by welding, and everything at present indicates that this art will find extended use in the railway industry as time goes on.

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The Railway Always Pays

Some of the compensation cases brought against railway companies in their early days, and the eccentricities of the awards made, are amusing reading today. We read for instance of a train which over-ran the platform at King's Cross station in 1862, and landed in the street beyond. One of the passengers had his head and shoulders injured, but was able to walk home. The next day, feeling ill, he returned to Liverpool, where he was laid up for some time. Medical men stated that he had become listless, helpless, and in fact quite a changed man. The brain had been disturbed, and *all objects appeared yellow to him.* With a view to making things a little more *couleur de rose,* the jury awarded him £1,200 damages. In another case a passenger was thrown about the carriage, but he was able to make inquiries on the spot as to the cause of the accident and to note its effects, which he communicated in a letter to *The Times* the same day. However, he soon fell ill, and stated that though he could take his two bottles after dinner "comfortably" up to the time of the accident, afterwards a single glass was the utmost he could venture upon. The railway company considered itself fortunate that his wine merchant did not bring an action for damages as well.

First Opening of the G.W.R.

THE first section of the Great Western Railway, between Paddington and Maidenhead (Dumb Bell Bridge)—now Taplow—was opened to the public on June 4, 1838. Those were still the early days of steam transport, and the opening of a new line of railway was an important event, but this particular opening was of greater significance, for the railway differed from all others then in being or in course of construction. A contemporary journal of May, 1838, had said:—

> Among all the lines in this country—not even excepting our good and great railway Adam—the Liverpool & Manchester—no one has ever more intensely concentrated public opinion upon it than the Great Western.

The reason for this exceptional interest was that, whereas other main lines of railway had been constructed to a gauge of 4 ft. 8½ in., the Great Western Railway was without precedent in that the rails were laid to a gauge of 7 ft.* The Act authorising the construction of the railway had contained no stipulation as to the gauge, and the Engineer, Isambard Kingdom Brunel, had persuaded the directors to make a drastic departure from previous railway practice. Brunel's broad gauge had excited considerable interest not only in this country, but on the Continent and, perhaps to lesser extent, in America. The complete railway was to be "114 miles in length from Bristol to a point of junction with the London and Birmingham line near Wormwood Scrubbs," the idea in mind being that the Great Western Railway would share a London terminus with the London & Birmingham Railway at Euston, or as the Act stated, "near the New Road in the parish of St. Pancras."

The adoption of Brunel's broad gauge presented obvious difficulties to the project of a joint terminal station in London, and it is not surprising that in July, 1837, powers were obtained to extend the Great Western Railway eastwards from Acton to a "certain piece of ground adjoining the canal in the Parish of Paddington." This involved the construction of an additional 4½ miles of railway, and the change also necessitated much work in the way of road diversions, and in the construction of new roads, as well as the building of a station at Paddington with the necessary terminal accommodation. In view of all this extra work and the engineering features of the line between London and Maidenhead, including the Wharncliffe viaduct 65 ft. in height and 896 ft. in length, spanning the Brent valley, it says much for the energy and driving force of Brunel that it should be possible to open 22½ miles of railway to the public less than three years after the passing of the Act on August 31, 1835. The site selected for the Paddington terminus was approximately that now occupied by the Paddington goods station. A temporary timbered structure was provided of which the Bishops Road bridge (constructed in connection with the necessary road diversions) formed the front, the booking office being in one of the arches and others being used as waiting rooms, and as entrances and exits for vehicular and other traffic. Incidentally this temporary station did duty (with some enlargements) for no less than sixteen years, that is, until the existing station was opened in 1854. The temporary western terminus at Maidenhead (Dumb Bell bridge) was also a timbered structure, and the only intermediate station completed at the time of the opening of the railway was that at West Drayton, where the locomotive depot for the railway was then located. Although intervention by the Eton College authorities had prohibited the erection of a station at Slough, trains were, none the less, stopped there and facilities for booking and receiving traffic provided at the Crown Inn nearby.

* 7 ft. 0¼ in. to be precise

The day of opening the railway was Whitsun Monday. It was gloriously fine; there were cheering crowds all along the line of route and on all bridges over the railway, and everything seems to have gone off well, including the cannons which were fired as the trains passed Ealing. There were four trains in the morning leaving Paddington at intervals from 8.0 a.m. to 12.0 noon, and four in the afternoon at each hour from 4.0 p.m. to 7 p.m. The first train was drawn by the locomotive *North Star* (Robert Stephenson & Company), and with its 200 passengers attained a speed of 36 m.p.h. This achievement seems to have been something in the nature of a "burst of speed," however, for Mr. G. H. Gibbs, the director-diarist records:—

> I went to Maidenhead by the first train and came back by the third, which started from Maidenhead at 10.15. I was disappointed with regard to the speed, as we were 1 hour and 20 minutes going down and 1 hour and 5 minutes coming up. If from the 65 minutes we deduct 4 lost at Drayton, 3 at Slough, and 4 between the two places and in slackening and getting up the speed, there remain 54 minutes for 23 miles, or 25½ miles per hour.

The locomotives used on this occasion had all been purchased from outside contractors, and with the exception of *North Star* were not a very satisfactory lot, and were destined to be the source of considerable anxiety, particularly to Brunel's youthful Locomotive Superintendent, Daniel Gooch, who was ten years younger than his chief, Brunel; in fact the combined ages of the Chief Engineer and Locomotive Superintendent of the Great Western Railway at the time of the opening on June 4, 1838, were something less than 54 years! Brunel, Gooch, and Saunders—the last named being the energetic first Secretary (London Committee) and General Superintendent of the Railway—were the three men, who in their respective spheres were responsible for laying the foundations of the Great Western Railway which came into use on June 4, 1838, and has thus completed a hundred years of public service.

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Workers' Control in Mexico

AMONG other remarkable developments in Mexico, not the least in importance is the recent decision of the Government to entrust the working of the National Railways to the railway employees. The system extends from Mexico City to the United States border at Ciudad Juarez, Eagle Pass, and Laredo, and penetrates into the State of Texas as far as the port of Corpus Christi. It comprises a route of 8,131 miles of which all but 1,276 of 3-ft. gauge lines is of the standard 4 ft. 8½ in. gauge. A council of administration, consisting of seven members elected by the employees themselves from among their number, has been appointed by the Government to assume the functions of a board of directors. The General Manager, like the directors, has been nominated by the syndicates, after an election among the employees. It is understood that the new council of administration will be responsible to the Ministry of Communications and Public Works, and although no information is available as to the question of finance, no doubt this will also be subject to the corresponding Ministry. It will be seen that this development in Mexico is quite distinct from forms of nationalisation and control which have been tried, with varying success, in other countries. The most recent experiment, in Republican Spain, took the form of control by a mixed committee, composed of an equal number of employees and State officials.

In Mexico now the management would appear to have a dual responsibility. By their election of the members of the council of administration the employees charge

them with the responsibility of producing certain results. At the same time it would appear that the council is also responsible to the Government to produce certain results. Exactly what results are demanded does not appear in the news of this development quoted in our report on a later page. Presumably they must be the same, and, that being so, the justification for the complicated process of an election by the employees is not immediately apparent. This question of control and administration, and the exact definition of their respective spheres, is important in any association if it is to be successful. The result aimed at has to be clearly understood by all concerned, and the administrators, who are held responsible for producing the result, must be free to adopt whatever methods they consider best for the purpose. Interference with methods of administration by outside bodies not directly responsible for producing the desired results immediately undermines the responsibility of the proper administrators, who cannot therefore be blamed should they fail.

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Antofagasta (Chili) & Bolivia Railway Co. Ltd.

INTERNATIONAL connections with Peru and Argentina are provided by the owned and operated lines of this company, which has two separate administrations, one at Antofagasta covering the lines in Chile, and one at La Paz dealing with the Bolivian lines. The railways throughout are of metre gauge. A system of waterworks is also part of the company's undertaking. The report for the year **1937** shows that the gross receipts of the whole undertaking amounted to **£884,153**, an increase of **£91,104** or **11·49** per cent., and the working expenses to **£570,696**, an increase of **£74,690** or **15·06** per cent., so that the net receipts of **£313,457** were higher by **£16,414** or **5·53** per cent. Net receipts from the waterworks were **£528** lower, at **£11,467**, but railway net receipts improved by **£16,942**. As in the previous year the sum of **£100,000** was received by way of dividend from the Andes Trust Limited, and the net income of **£7,785** from Bolivia Railway bonds was **£1,349** higher. Debenture interest was fully covered, and the amount to be provided in connection with the lease of the Aguas Blancas Railway was reduced from **£49,816** to **£46,068**, because the operation of that railway resulted in a profit of **£1,047**, as against a loss in **1936** of **£1,555**. Arrears of dividend are being paid on the **5** per cent. cumulative preference stock, namely **2½** per cent. balance payable in respect of **1934**, and **1¼** per cent. on account of the year **1935**. The accompanying table compares the financial position of the past two years:—

	1937	1936
	£	£
Railway gross receipts	849,313	762,941
Railway working expenses	547,323	477,893
Railway net receipts	301,990	285,048
Total income	589,545	620,446
Debenture interest, rentals, &c.	276,515	280,264
Exchange reserve	53,000	104,000
Preference dividend arrears	125,000	100,000
Carried forward	135,030	136,182

Compared with **1936**, most classes of traffic gave increased tonnages but particularly nitrate and copper bars in the down traffic and general merchandise, articles for the mining industry, coal and fuel oil in the up traffics. The principal decreases recorded were in sulphur, blends and silver and other low grade ores. There was a considerable increase in the number of first and second class passengers carried in Chile. In Bolivia, the first class traffic was well maintained, but less Government traffic caused a fall in second class. Passenger and goods traffics of the Chilian Northern Longitudinal Railway, which is operated by the Antofagasta Company for account of the Chilian Northern Railway Company, gave satisfactory increases, and on the Bolivia Railway Company's lines there was an improvement in goods traffic but the sterling equivalent of receipts was less owing to the lower official rate of exchange ruling throughout **1937**. Passenger traffic was well maintained.

The operating ratio in railway working expenses rose from **62·64** per cent. to **64·44** per cent. The increased expenditure is attributable to the heavier traffics, increases in currency salaries and wages, additional contributions payable under the social laws, and the higher cost of fuel and materials generally, particularly materials imported into Bolivia which had to bear customs duties, &c. Prior to November **27**, **1936**, the company was exempt from these duties. Contributions to renewals accounts were also greater than in **1936**. Capital expenditure during **1937** totalled **£44,835**. This included cost of purchase from the Aguas Blancas Company and conversion to metre gauge of **60** wagons, additional housing accommodation, and a new siding at La Paz. The company is converting **100** thirty-ton flat cars to open goods wagons. The different types of traffic requiring to be handled, such as bulk nitrate instead of sacked nitrate and Chilean coal instead of petroleum, have had the effect of virtually putting out of service a large number of flat cars and tank wagons.

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Gravitation Yards

SOON after railways became a practical means of long-distance communication, the greatly enlarged facilities they afforded compared with the limited capabilities of road transport led to an extraordinarily rapid growth of traffic; convenient means of marshalling, separating, and re-combining the vehicles in goods trains were therefore seen to be essential to efficient operation. The groups of sidings soon installed at the larger centres, with their numerous switches and means of working them, thus assumed an importance of their own in no way inferior to the other parts of the railway, while the cost of conducting shunting movements formed a considerable item in the general expenditure of the large railway systems. Shunting, indeed, was costly not only in the power required to perform it, but in time and wear and tear of vehicles, as well as in compensation claims if careless movement caused damage to their contents. This side of railway work developed for some time without much scientific attention being bestowed on it, but in **1895** it was deemed of sufficient importance to be discussed at the International Railway Congress, held that year in London. By degrees, the possibility of reducing costs and increasing efficiency attracted more serious attention, and the layout of yards, the means of braking wagons and reducing rough treatment, the adoption of electric signalling apparatus and other facilities for rapidly controlling the large number of movements required, were more and more scientifically investigated.

To use the force of gravity where possible to reduce the locomotive power needed, was a natural thought that found expression at Edge Hill, Liverpool, and elsewhere many years ago, but its full development had to await technical progress in wagon braking and point operating. Thus there was developed the mechanised yard, as it is now called, numerous examples of which were built after the war when the cutting of costs became more pressing. Before the war, however, ingenious systems of rapid point setting for yards had appeared, and have since been followed by others, including magazine and other automatic features of very interesting types. Shunting yards have

indeed become a specialised study, touching civil, mechanical and signal engineers in varying degree. They were again discussed at the London International Railway Congress in 1925, and, as regards braking apparatus more particularly, at the Madrid Congress in 1930. An informative addition to the literature of the subject was made by Mr. J. C. Kubale in his paper before the Institution of Railway Signal Engineers on May 25 last, when he dealt with some engineering aspects of the question and discussed the behaviour of wagons of various characteristics during hump shunting, the best gradients to choose in designing yards; the action of rail circuits in point setting control; yard capacity; and the estimation of the number of point movements required. Few other original contributions to the mathematics of the subject have as yet been made in England, the best known being, we believe, that due to Mr. A. A. Syer in 1932; but many Continental writers have dealt with it, both in papers to the congresses above mentioned and the periodical reports of the German *Studiengesellschaft für Rangiertechnik*, as well as in technical journals, where much information is to be found. Indeed, few aspects of modern railway working have been so much written about or been the subject of more varied suggestions and practices. The different systems of point setting alone form a study in themselves.

Although the hump and retarder system, despite the difficulties associated with good and bad running wagons, variations in weather, wind pressure and other factors, has given excellent results, there have not been wanting proposals for apparatus which will accurately control every wagon from the beginning to the end of its run, regardless of widely varying conditions, nothing being left to judgment and all risk of overtaking or colliding with other vehicles in sidings being automatically eliminated. A year or so ago a French authority on the subject pronounced the problem to be virtually solved, but of what practical effect has been given to his ideas we are not as yet aware. Existing methods have already saved the railways large sums of money and have been one of their principal aids in holding their own against competing methods of transport. Further improvement would, however, still be welcome.

* * * *

Modern Steel Stock Practice

OUT of 470 passenger coaches ordered in the U.S.A. during 1937, 370 have bodies of stainless or high-tensile steels, and the remaining 100 have plain carbon-steel bodies. Low-alloy high-tensile steels were applied also to 5,000 freight cars ordered in 1937. According to Mr. Ralph Budd, President of the Burlington Lines, his company built 1,000 box cars in 1937, using moderate amounts of alloy steel. Compared with 1,000 similar cars built in 1928 of what were then standard materials, the new cars weigh 20 per cent. less per cu. ft. of capacity, and the cost of maintaining them will be considerably less. When a loaded train is made up of these new vehicles more of the total weight is revenue-producing; when they are handled empty, the cost of moving them is less. Experience on various lines has indicated that the life of comparatively thin high-tensile steel sheets will be almost as long as that of ordinary low-tensile copper-bearing steel of standard thickness. Experiments are now being carried out with somewhat thicker sheets of fairly high-tensile steels with great corrosion-resisting properties, to see whether an optimum thickness and method of construction can be evolved, which will give greatest life coupled with minimum maintenance and weight. Modern designs of freight stock using high-tensile alloy steels can be built at a cost no greater than that of carbon-steel stock.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Courtesy and Salesmanship

2, Montpelier Road, Ealing, W.5
June 2

To the Editor of The Railway Gazette

SIR,—Never was there a time more than today when efficiency, tact, and courtesy were more essential in the commercial world, and the more railway staff develop these qualities the more the receipts are bound to increase. The British railways enjoy a high reputation for courtesy, a reputation it is in the power of those whose duties bring them in daily contact with the public appreciably to enhance. An inferiority complex is neither necessary nor desired, and whilst always treating the companies' patrons with respect the staff are thereby increasing the prestige of their employers.

Transport competition is so keen today that constant vigilance on the part of railway companies is needed and their outdoor staff should be fully equipped with the case of rail *v.* road. For example—railways, which are so essential to the life of the nation, with no outside assistance make and maintain their lines, whereas road transport concerns have the free use of the highways. This is manifestly unfair. Unfair because railways are common carriers under legal statute while road transport can pick and choose. There is much the railways have to sell. For example:—

(*a*)—Parcels traffic by express service enabling a firm to hand over the whole of its output, with no limitation as to weight or size of packages, or destination.

(*b*)—Holidays and outings by railway companies who are prepared to do everything possible to meet the requirements and comfort of their patrons. Readiness with suggestions as to attractive venues for parties where meals can be obtained and other things co-incident with such events, and in this way if organisers see the railways are making their interests their personal concern they are bound, in the long run, to secure their confidence, with the inevitable result—business for the British railways.

The public cannot too often be reminded of the vast facilities provided by the railways of this country. Again as an example—express trains through the night conveying newspapers, milk, fish, fruit, vegetables and other traffic for the early morning markets unsurpassed, if equalled, by any other railways in the world.

Yours faithfully,
A. H. SEARSON

RECONSTRUCTION OF L.N.E.R. CALDER BRIDGE, WAKEFIELD.—One of the most intricate railway bridge engineering jobs of its kind for some years is to be carried out by the L.N.E.R. during the last fortnight in June. This is the reconstruction of the bridge carrying the L.N.E.R. main line from Doncaster to Leeds over the River Calder between Sandal and Wakefield stations. This structure, officially known as Bridge No. 60, was built in 1865, and has a single span of 170 ft. It crosses the River Calder on the skew, which contributes to its handsome appearance, but renders reconstruction a complicated matter. It has been the aim of the L.N.E.R. engineers to perpetuate the handsome lines of the existing bridge, and the firm of Dorman, Long & Co. Ltd., of Middlesbrough, builder of the famous Sydney Bridge, has been engaged for some months on the construction of the steelwork for the new structure. A considerable amount of preparatory work has been carried out, and the final stage of the work will take place during the period Sunday, June 19, to Saturday, July 2, inclusive. During this period it will be necessary for all trains passing over this section of the Leeds-Doncaster main line to be diverted to alternative routes, and Sandal station will be closed for all traffic during the time the reconstruction is proceeding. When the work is completed, the present speed restriction over the bridge will be withdrawn.

PUBLICATIONS RECEIVED

Dublin Historical Record, Vol. 1, No. 1, March, 1938.—A quarterly published by the Old Dublin Society. 9½ in. × 6¼ in. Price 1s. 6d.—We have recently received a copy of the first number of a quarterly magazine which is being produced by the Old Dublin Society in order to preserve records of the history and antiquities of the city and neighbourhood. The foreword explains that the major part of every issue will be occupied by historical papers read at the meetings of the society, supplemented by shorter contributed notes and answers to queries. The first number begins the serial publication of Mr. Kevin Murray's admirable paper entitled "Dublin's First Railway," which was delivered a few months ago, and to which we have already referred in our columns. This quarterly will doubtless be welcomed by all students of Irish history, and the production and contents of the first number are such as to cause the enthusiast to wish that a monthly rather than a quarterly were not impossible on financial grounds.

North East England Holiday Guide.—Published by the North Eastern Development Board, 162, Northumberland Street, Newcastle-upon-Tyne, 1. Illustrated; with coloured folding map. 120 pp. Price 6d. net.—This booklet, which is finely illustrated and printed in clear, easily-read type, is a guide to the counties of Northumberland, Durham, and North Yorkshire. An excellent choice of tours and visits is available within these limits, including the extensive remains of Hadrian's Wall (the great Roman "Maginot Line," which stretched from the Tyne to the Solway Firth), the Cheviots and moorlands, the ancient cathedral city of Durham, Scarborough (the "Queen of Watering Places"), the Yorkshire Dales, and the Yorkshire abbeys and castles. The preface to this volume, written by the Marquis of Londonderry, President of the N.E. Development Board, takes the form of an invitation to holidaymakers to sample the many attractions which the North-East of England holds in store for visitors.

The Story of the Brake Shoe.—A brochure which we have received from the American Brake Shoe & Foundry Company, New York, entitled "the Story of the Brake Shoe; from Roman Carts to Streamlined Trains," is of exceptional interest, and although issued as a trade publication is well worthy of permanent preservation as a work of reference. It begins by reproducing one of the earliest known illustrations of a wheeled vehicle, which appeared on a Chaldean seal about 2000 B.C., and from that time onwards outlines the development of early brakes through 40 centuries. Many fascinating illustrations enliven the brief though well annotated text, and it is of no small interest to see the germ of the modern brake in a crescent-shaped scoop or rim shoe illustrated in the *Heidelburg Codex* of 1486. Railway braking in England is traced from early days of horse-operated mineral tramroads, and among many curiosities is Le Caan's automatic safety brake of 1798. Early patents for continuous brakes and steam brakes are also mentioned, and a brake shoe testing machine (designed by F. W. Sargent of the Chicago, Burlington & Quincy Railroad) comes into the story in 1889. The second part of the brochure is entitled "How the Modern Brake Shoe was developed," and this, of course, outlines the work and products of the American Brake Shoe & Foundry Company up to the present time.

Electrical Condensers.—Fixed capacity condensers have various applications in circuits for telephonic or radio communication, and for neon signs. A catalogue of condensers from British Insulated Cables Limited, Prescot, Lancs, shows a wide range of standard types and capacities for radio and general use, and for working voltages of from 250 to 6,000 V. d.c. Where a paper dielectric is used, this is impregnated with a special petroleum jelly, and the metal cases are hermetically sealed. The high-voltage types are recommended for by-passing to earth high-frequency disturbances caused by sparking at the brushes of d.c. motors and dynamos, and likely to cause interference in radio reception circuits. A special range of telephone and telegraph condensers is listed, characterised by a compact shape that allows of easy packing on racks on switchboards.

El Cordobes.—The Central Argentine Railway has published an illustrated booklet describing the new Buenos Aires—Cordoba daylight express service—El Cordobes—the composition and schedule of which are the subject of an Overseas paragraph on page 1101. Emphasis is laid in the text upon the fact that with its air-conditioned coaches and fast schedule this train represents an innovation in South American railway travel. On the folding centre page is reproduced a bird's-eye view of the train with the roofs of the coaches cut away to give a general impression of the colour schemes of the different coaches. Photographs are reproduced of, among other subjects, the American bar, the saloon coaches with their revolving armchair seats, and one of the restaurant cars. Various minor conveniences of the train are illustrated by black and white sketches. Tickets, for example, can be placed in a clip combined with the reservation number plate for every seat, where they are available for the collector when required without his having to call upon the passenger to fumble in pocket or bag. The booklet has an attractive blue cover, with a view of the train, and an insert showing the timetables and fares has on the back a pictorial diagram of the air-conditioning system.

Engineering Exports.—We have received from the *British Engineers' Export Journal*, of Dorset House, Stamford Street, London, S.E.1, a comprehensive survey of British engineering exports to the principal countries of the world. Engineering exports to 112 countries are tabulated under about 80 different headings. The value of the classified exports reaches the total of £36,075,000, British electrical machinery leading with a total of £8,673,000, to which South Africa made the largest contribution. The statistics are intended to provide manufacturers and exporters with a reliable guide to the many categories of engineering exports upon which to base their plans for future development. The analysis is produced in folder form, and costs 10s. 6d., post free.

Electric Mortisers.—Characteristic mechanical features of electric mortisers are illustrated in a folder we have received from Thomas Robinson & Son Ltd., Railway Works, Rochdale, England (which company celebrated its centenary on January 1 this year). These machines include various refinements, including a chain cutter and hollow chisel grinder of patented design, and an automatic stop for the chain and chisel auger to hold them in their top position when the machine is not running. A blower keeps the stock clear of chippings when the chisel is being used, and an exhaust fan functions similarly for the chain. A low-voltage spotlight can be fitted to illuminate the work if required. A special spacing-out and line-indicating attachment is supplied, which, used in conjunction with wooden templates for standard production lines, saves laborious marking out of stock.

Cutting Tools.—A manual dealing with the manufacture, applications, and maintenance of Stellite-tipped tools reaches us from the Deloro Smelting & Refining Co. Ltd. (of Canada), Highlands Road, Shirley, Birmingham. Deloro Stellite is a non-ferrous alloy of cobalt, chromium, and tungsten that loses but little of its original hardness at the elevated temperatures met with in cutting at high speeds. Arising out of this characteristic, also, is a remarkable resistance to abrasion. The manual provides practical information for the engineer in the shape of hints on grinding Stellite tools, recommended speeds and feeds for different jobs, and directions for tipping existing tools with Stellite by the oxy-acetylene or furnace processes. Stellite is also suitable for the hard-facing of wearing parts, instructions for which are provided. Apart from tools, Stellite is used for numerous engineering parts requiring resistance to heat, abrasion, and corrosion, specimens of which are illustrated.

THE SCRAP HEAP

DANGEROUS EATABLES

A message from one of the leading British press agencies published in a European paper in India reads as follows:—

EXPLOSION ON RAILWAY TRACK

Jullundur, May 31

A terrific explosion occurred on the main line railway track near Phagwara on the night of May 29.

It is reported that some explosives wrapped in jute strings burst on the railway line when the 76-Down train was passing over it. No serious damage, however, has been reported.

Some screws from the railway lines were found removed, while some plates containing eatables were found scattered near the scene of the explosion.

The condition of the "fish and chips" must have been fairly violent to have caused such a "terrific explosion."

* * *

The *Liverpool Standard* of May 20, 1848, said that "on Thursday week, the one o'clock train, consisting of four carriages, left Liverpool for London without a single passenger. Such a circumstance never occurred before."

* * *

MIND THE DOORS!

Our editorial note "Mind the Doors" in our issue of May 27, appealing for more dulcet delivery of the well-known Underground slogan "Mind the doors," evoked the following comment in *The Star* by the Western Brothers—well-known arbiters of good form and polished diction. We reproduce the poem by the courtesy of the Editor of *The Star*:—

A suggested innovation in the *Railway Gazette*,
Affecting Tube Railways, would cause
A robot to shout in accents quite dulcet,
"Mind the Doors!"

At present a porter provides this remark,
And Londoners know what he roars,
But foreigners find that they're quite in the dark.
"Mind the Doors!"

If he's a Cockney they stare with surprise,
These visiting folk to our shores.
He cocks his thumb over his shoulder, and cries,
"Mine-er-Dawers!"

If he's a College bloke as the train waits,
It seems he does not care two straws,
He just nods his head to the exit, and states,
"Mend-the-Daws!"

He may have hay fever, a cold in the head.
And has to take care, they're implored,
They look at each other and think that he said,
"Bind-der-Dord!"

By all means have robots without vocal flaws.
But since we must pack and must squeeze,
In addition to bawling out loud, "Mind the Doors!"
Why not say "Please"?

Steam interferes with the comfort of travelling, philosophised Samuel Brock, who died in 1862. "It destroys every salutary distinction in society, and overturns by its whirligig power the once rational, gentlemanly, and safe mode of getting along on a journey. Talk of *ladies* on board a steamboat or in a railroad car! There are none. To restore herself to her caste, let a lady move in select company at five miles an hour."—*From "American Lands and Letters," by Donald G. Mitchell.*

* * *

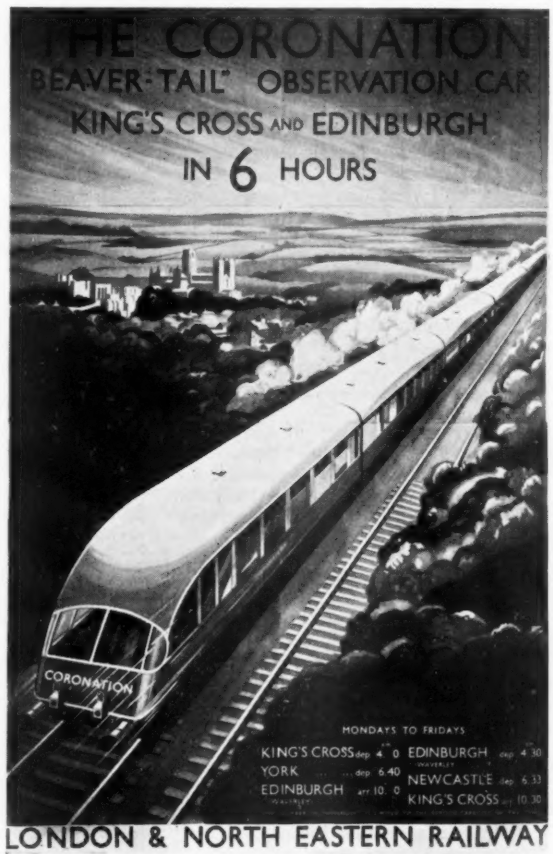
When Sir James Allport was manager of the Newcastle & Darlington Railway, he was a close friend of Colonel and Mrs. Allison, who were Mayor and Mayoress of Sunderland at the time of George Hudson's election campaign. "I remember," says Colonel Allison in his recollections, "that it was on August 14, 1845, that Mr. Allport came to me at the polling booth, and asked me to go with him to London with the report of the Railway King's victory. I agreed to go, and we started from the Monkwearmouth railway station. The train consisted of an engine, a guard's van, and two first class carriages. We went *via* Brockley Whins, and crossed the Victoria Bridge at Biddick. Everything went pleasantly until Darlington was reached, when the guard refused to go an inch farther with a train that had been travelling over a mile a minute. A fresh guard was procured and the train proceeded to York, the reporter who was travelling with us writing out his copy as we went along. On arrival at London we obtained two cabs, and drove direct to *The Times* office. On the way the cab with the reporter in was detained by the horse falling down. At *The Times* office the reporter handed in his copy to the foreman printer, who cut it into small 'takes.' While the compositors were setting it up we were entertained in the editor's room with a champagne supper, at the expense of *The Times* proprietors. Afterwards we saw the papers printed containing an account of the election, and our railway ride. After being in London about three hours we left *The Times* office, taking with us 500 copies of the paper, and returned by train to Monkwearmouth station, arriving shortly after ten o'clock in the morning. We arrived with the papers in the midst of the ceremony of 'chairing' the new Member, and Hudson took a number of them and flung them among the crowd, crying: 'See the march of intellect.'"

* * *

High explosive shipments totalling 450,000,000 lb., including dynamite, black and smokeless powder, explosive ammunition and blasting caps, were handled by American and Canadian railroads in 1937 without the loss of a single life. During the past eleven years very large quantities of high explosives have been transported by the railroads of the United States and Canada without a fatality.

* * *

A station agent who never sees a train during working hours is Mr. H. D. Patterson, of Battle Ground, near Kelso, Washington. The only train serving Battle Ground works on Sundays while Mr. Patterson is off duty.



Coming or going? Not a diesel train approaching, but the L.N.E.R. Coronation train with beaver-tail observation car receding, is shown on this poster

OVERSEAS RAILWAY AFFAIRS

(*From our special correspondents*)

ARGENTINA

New Central Argentine Air-conditioned Train-de-luxe

During April, the Central Argentine Railway initiated a new departure in South American railway operation by inaugurating a fast, daylight, air-conditioned *train-de-luxe* between Buenos Aires, Rosario, and Cordoba. The new train, known as *El Cordobés,* incorporates a number of amenities and innovations hitherto unknown on Latin-American railways. As well as the air-conditioning and elimination of dust, the dignified comfort of the saloon coaches and dining cars sets a new standard of elegance.

The service is at present bi-weekly in each direction, the train leaving Buenos Aires on Wednesdays and Saturdays at 9 a.m., arriving at Rosario (188 miles) at 12.45 p.m. and Cordoba at 6.30 p.m. The return journey is made on Thursdays and Sundays, leaving Cordoba at 2 p.m., arriving at Rosario at 7.25 p.m. and Buenos Aires at 11.30 p.m. The distance between Buenos Aires and Cordoba is 432 miles, and the schedule time for the journey —9½ hours—marks the highest average speed of any long-distance train in regular operation in South America.

Description of the Train

The train is composed of four semi-Pullman saloon coaches, each with a seating capacity for 56 passengers; two dining cars, each with seating accommodation for 44 passengers; and a brake van. The interior decorative schemes of the different coaches are based on green, blue and brown; the floors are carpeted, and the saloon coaches are equipped with comfortable revolving seats. A system of internal telephones enables the saloon attendants to communicate passengers' requirements to the dining car conductor. A cocktail bar is located at one end of each of the dining cars. The cooking and hot water equipment in the kitchen is effected by Supergas stoves and heaters, the gas cylinders being stored in a ventilated compartment in the side of the coach adjacent to the kitchen.

The conversion of the semi-steel coaches composing the train, and the insulation and air duct installations were carried out in the company's workshops at Rosario. The air-conditioning apparatus was supplied by J. Stone & Co. Ltd., Deptford, England.

All the seats are numbered and reserved, there being a small supplementary charge for reservation, over and above the first class return fare, of $6.00 each way between Buenos Aires and Cordoba, and $5.00 between Buenos Aires and Rosario or Rosario and Cordoba, and *vice versa.*

The inaugural run was made on April 27, the train arriving at Cordoba punctually, after a 15-min. intermediate stop at Rosario.

Wage Deductions

After the authorisation granted to the B.A. Pacific and Western Railways to make salary and wage deductions as from April 1, recorded in The Railway Gazette of April 22, it was announced on April 22 that similar authorisation had been granted to the *Compañia General de los Ferrocarriles* of the Province of Buenos Aires. As in the case of the other two railways, the Government's decision was based on the fact that the decline in the receipts made it necessary to curtail expenditure by reducing salaries and wages, as provided for in such circumstances by the Presidential Arbitration Award of October, 1934. The deductions made by the *Compañia General,* which also came into force on April 1, apply to all departments and categories of the staff, except in the workshops, where a system of " short time " will be established, averaging about 6.6 per cent.

This proposal caused a certain amount of discontent and agitation among some sections of the workmen and outside staff, who called a meeting to protest against the measure, urging the central committee of the *Union Ferroviaria* to take action in the matter. The latter, however, evidently realises that the serious financial situation with which the companies are faced compels them to adopt every measure which is open to them to reduce working expenses as far as possible, and in view of this the men's leaders are not disposed to provoke a conflict with their employers over a question in which the latter are indisputably acting within their rights, and in which they would undoubtedly have the full support of the new Government, which is hardly likely to repudiate President Justo's award. In spite of the attitude of moderation so far shown by the unions and the fact that up to now they have declined to countenance strikes, a section of the outside staff of the Western Railway, acting on its own initiative, declared a 10 minute stoppage on May 3.

SOUTH AFRICA

East London Developments

From East London northwards along the Cape Eastern main line, several deviations are in hand. Two, between East London and Chiselhurst and between Chiselhurst and Ocean View, have been completed, and four others extending to Anabele are being undertaken. Some two-thirds of the first of these, Ocean View—Wilsonia, have been completed, and a subway and overbridge on the deviation eliminate two main road level crossings on the existing line; this section should be completed in the autumn. Work is also in hand on two distinct deviations, aggregating 2½ miles, between Arnoldton and Egerton, and these also should be completed shortly.

The remodelling of the East London locomotive yard is now in hand. A direct-steaming plant is to be installed in the new engine sheds to eliminate the smoke nuisance of lighting up in this populated area.

Over half the 1,000-ft. extension of the south breakwater at East London has now been practically completed. Some 5,000 30-ton concrete blocks, requiring over 80,000 cu. yd. of concrete have already been cast and nearly all have been dumped; the concrete superstructure is also well in hand.

NEW SOUTH WALES

Rail Lubricators

The Aladdin type of track greaser has been adopted by the Government Railway Department after extensive practical tests. It is found that with this device using grease of proper consistency, the lubricant is delivered to the running side of the rail and distributed round the curve by the wheel flanges without splashing on to the head of the rail.

The device was first tried on the tunnel section of the electrified City Railway carrying very heavy traffic

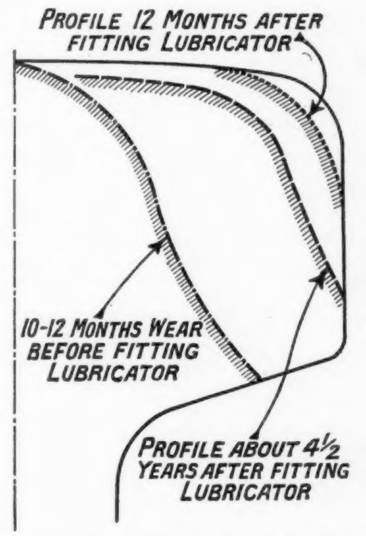


Diagram showing increased life of rail on 12-ch. curve due to lubrication

and the results were so satisfactory that the use of the lubricators has now been extended to the steam lines; 3,051 have been fitted to the electric and steam tracks to date.

These lubricators are maintained by a special staff. The only duties performed by the fettling gangs are to see that the lubricators are kept filled, to report when adjustments are required and to remove the lubricators

when rerailing or ballasting is about to be carried out.

The cost per annum each of maintaining the lubricators is as under:—

	s.	d.
Workshops	1	7
Field wages and expenses ...	16	0½
Lubricant	8	2½
Other stores and cartage ...	0	8
	26	6

With regard to the saving which is being effected, it is apparent that the life of rails on the worst curves will be extended at least four times, the indications being that the rails on curves will be made to last as long as those on tangents by lubricating them with the Aladdin device. Further, the use of expensive manganese rails for renewals of the outer rails of curves has now been discontinued and there is definite evidence of an extension of the period between re-turning of wheel tyre flanges. The profile on the previous page is typical of results obtained on a 12-ch. curve between Milsons Point and Hornsby.

UNITED STATES

Wage Reduction Resisted

The debaclé of the American railroads becomes steadily more complete. The managements have served notice on the unions of their intention to reduce wages by 15 per cent. on July 1, and the union leaders have indignantly refused to make any concessions whatsoever, and have stated that they will call a strike before they will submit. There is, to be sure, no immediate danger from this threat, because the notice of a wage reduction served by the railroads is merely a formal step required under the law as a preliminary to negotiations.

But the unions have gone farther than mere refusal to entertain wage reductions, and have enlisted the aid of several powerful members of the Senate, who have announced that they will block the passage of proposed railroad relief measures (principally loans on easy terms from the Government-owned Reconstruction Finance Corporation) for the benefit of any railroads which reduce wages. This declaration is tantamount to restricting Government loans to the payment of operating expenses, because many railroads are barely meeting such expenses at the present time. They need the wage reduction in order to give them a slight margin of earnings above operating expenses, but the argument of the Senators is that no Government loans should be made to railroads that reduce wages.

Victims of Politics

It would thus appear inevitable that many more railroads will shortly have to admit their insolvency unless there is some unforeseen softening in the adamantine position of the unions. There is a general Congressional election in November, and opposition critics of the New Deal Government believe that the latter will go to any lengths to curry favour with any large group of voters such as the railway unions represent. The National Mediation Board, upon whom would devolve the conduct of wage decrease negotiations, is supposed to have three members, but there are only two now sitting. Both of them are nominees of President Roosevelt and both were long identified with the labour union movement before their appointment.

Increased Rates Just Balance Decline in Trade

Preliminary earnings reports for April (the first month when the rate increases authorised by the Interstate Commerce Commission were in full effect) indicate that gross receipts were approximately 25 per cent. below those of April, 1937. This is exactly the percentage by which March receipts were less than those of March, 1937, so apparently, the decline of business from March to April has exactly offset the benefits of the rate increase.

Eastern Lines Try Again for Higher Fares

Meantime the Eastern railways have asked the Interstate Commerce Commission to reconsider their petition for the right to increase coach fares from 1d. to 1¼d. a mile, recently rejected by the Commission by a vote of 5 to 4. The I.C.C. in refusing to grant the increase held that the present 1d. rate would earn more money for the Eastern railroads than would a higher rate. The railroads contend that if this decision is allowed to stand "private management is destroyed" and the Commission will have usurped "the prerogatives of ownership without any of its responsibilities." The three largest passenger-carrying roads, the New York Central, the Pennsylvania, and the New York, New Haven & Hartford, earnestly believe that the higher rate would be more remunerative.

Wages of Railway Employees

In denouncing the railroads in the Senate for their wage reduction proposal, Senator La Follette stated that "contrary to widespread propaganda, railroad wages are not high." He then cited wages of permanent way labourers, mostly on Southern railroads where many negroes are employed in such work, varying from 10½d. to 1s. 7d. an hour. There are undeniably many railway workers whose earnings are comparatively modest. Your correspondent has before him, however, wages paid and hours worked by typical engine and train service employees—neither the best paid nor the lowest—on a mid-Western railway in a recent month, which were as follow:—

Occupation	Actual miles per trip	Total miles paid for	Total monthly earnings £ s. d.	Number of trips in month	Aggregate time on duty Hr. min.
Passenger conductor ...	283	5,660	57 3 4	20	150 50
,, ,, ...	209	6,307	63 14 2	30	195 18
,, ,, ...	303	6,934	70 0 7	20	197 03
Passenger brakeman ...	283	5,660	41 1 10	20	150 50
,, ,, ...	209	6,307	45 15 10	30	195 18
,, ,, ...	303	6,934	50 6 10	20	197 03
Passenger engineer ...	120	4,257	62 9 10	30	118 00
,, ,, ...	122	4,769	67 0 5	39	177 08
,, ,, ...	151	4,779	67 11 1	27	153 54
Passenger fireman ...	120	4,257	47 17 0	30	118 00
,, ,, ...	151	4,180	45 2 0	24	136 48
,, ,, ...	124	4,738	53 4 11	38	170 03
Freight conductor ...	139	4,115	58 2 10	27	164 04
,, ,, ...	114	3,932	56 1 11	34	192 38
Freight brakeman ...	139	4,115	46 0 1	27	164 04
,, ,, ...	114	3,881	44 9 1	33	193 31
Freight engineer ...	139	3,629	63 18 10	26	140 08
,, ,, ...	145	3,347	58 19 11	23	158 58
Freight fireman... ...	139	3,629	49 13 10	26	140 08
,, ,, ...	145	3,347	45 16 8	23	158 58

Since train service wages are standardised throughout the United States, the above may be taken as typical and in no sense exceptional. Such earnings compare favourably with those of many practitioners of medicine and law; and are well above the stipends enjoyed by most clergymen and schoolmasters. For a bankrupt industry to be forced to continue to pay such wages, and at the same time to be accused in the United States Senate of paying low wages (and no Senator denied the allegation) may perhaps indicate the extent to which the railroads are the prey of reckless political exploitation.

CHINA

Hankow-Kowloon Through Running

It appears that war considerations have finally overcome Chinese prejudice, in that the Canton—Hankow and Canton—Kowloon Railways have now been linked up where they cross one another at Saichuen, outside Canton. This is obvious from the fact that H.B.M. Ambassador, Sir Archibald Kerr, and party left Hankow for Hong Kong direct on April 25, proceeding without change of carriage to Kowloon. Formerly the Cantonese authorities, wishing to develop their own port at Whampoa, would not agree to this Saichuen connection, as they feared that trade would flow to and from Hong Kong instead of *via* Whampoa.

HIGH-SPEED ELECTRIC RUNNING ON THE PENNSYLVANIA

Single-headed trains weighing from 940 to 1,000 tons are hauled for considerable distances at average speeds exceeding 80 m.p.h.

ON various past occasions attention has been drawn by THE RAILWAY GAZETTE to the speed enterprise of the Pennsylvania Railroad of the United States, which, as was shown in the article entitled " World Railway Speed in 1937 " in the February 4 issue, holds the world's record for aggregate high-speed mileage. The part played by electricity in achieving this record was made clear, for the Pennsylvania has developed higher running speeds over its densely-occupied electrified lines than any other railway in the world. The details that follow show that these speeds are even greater than the fast schedules might indicate, the cautious travelling needed in approaching and leaving the larger cities on the route, over curved tracks and through freight yards, as well as certain other service slacks, making necessary some very fast running intermediately. We are indebted to Mr. Eric Crickmay for the details which follow of some of the normal present-day running over New York—Washington main line, and also to Mr. W. D. Wiggins, Chief Engineer of the Pennsylvania Railroad, for a profile of the route, from which the particulars of its gradients have been quoted.

New York to Washington

From New York Mr. Crickmay travelled by the Judiciary, which was made up to a weight of 670 English tons tare or 700 tons gross; the locomotive was No. 4850 of the " GG1 " class, and the 2-C-C-2 wheel arrangement. The first 10·0 miles from New York Pennsylvania Terminal to Newark, including the 1 in 70 climb out of the tunnel under North River, occupied 13 min. 21 sec. start-to-stop. Despite a service slack between Elizabeth and South Elizabeth, the 8·7 miles from leaving Newark to passing Linden were covered in 10 min. 17 sec., and the next 29·7 miles, to Princeton Junction, took 24 min. 16 sec., at an average of 73·4 m.p.h.; for the 48·1 miles from Newark to Trenton the time was 44 min. 41 sec. The only adverse grade worth mention on this length is 4 miles averaging 1 in 240 from Perth Amboy to Metuchen. The next section of 27·9 miles from Trenton to North Philadelphia was completed in 27 min. 47 sec. start-to-stop, entailing an average speed of 70·9 m.p.h. over the 21·5 miles from Morris Tower to Bridesburg, and a maximum of $81\frac{1}{2}$ m.p.h. at Holmesburg Junction; Croydon, 12·6 miles from the Trenton start, was passed in 12 min. 22 sec. After stopping at 30th Street, Philadelphia, the train covered 11·2 miles from Glenolden to Claymont at an average of 75·4 m.p.h., twice reaching or slightly exceeding 80 m.p.h., and was then checked by signal at Holly Oak, but ran the 25·5 miles from 30th Street, Philadelphia, to Wilmington, in 26 min. 22 sec., start-to-stop. There was some fast running on the next section, to Baltimore. After covering the 6·2 miles from the dead start to Stanton in 6 min. 48 sec., the train ran the next 26·0 miles, to Perryville, at an average of 80·1 m.p.h., with a maximum of 83, and was then slowed to 30 over the viaduct at Havre de Grace (33·4 miles from Wilmington, passed in 28 min. 5 sec.). This high average speed was made over undulating track, with maximum grades of 1 in 166; there is one 3-mile bank so inclined, and several other sharp inclinations. Then followed 24·0 miles from Oakington to Stemmer's Run at an average of 79·1 m.p.h.—completing 50 miles of the one section at but a fraction under 80 m.p.h.—with a maximum of $84\frac{1}{2}$ m.p.h., and after the slow approach necessary, Baltimore, 68·4 miles from Wilmington, was reached in 58 min. 48 sec. The average speed from start-to-stop, including service slacks, had been 69·8 m.p.h. The exit from Baltimore is as slow as the entrance, being made up a 1 in 72 grade, and the first 2·7 miles, to Edmondson, took 5 min. 55 sec.; but the 27·3 miles from Halethorpe to Cheverly were run at 78·0 m.p.h. (maximum 82), and the 40·1 miles from Baltimore to Washington, with a very slow approach, in 40 min. 31 sec. There are several steep climbs on this section, notably the rise of 135 ft. in 4 miles from Patapsco to Severn, averaging 1 in 156, and as steep in parts as 1 in 100, and one or two other shorter banks of the same inclination. The timetables show only departure times from intermediate stations, but allowing the customary one-minute American stops, the total gains on schedule from New York to Washington amounted to $15\frac{1}{2}$ min. On this journey an average speed of 75·1 m.p.h. was maintained for a total distance of 155·6 miles.

Mr. Crickmay returned by the Congressional, which is one of the crack trains of the day, with the result that even higher speeds were obtained, notwithstanding the fact that the train was made up to 940 English tons tare (975 tons gross); another " GG1 " locomotive, No. 4861, was at the head. After the slow exit from Washington (7·1 miles, of which the first two are at 1 in 110 up, to Landover in 9 min. 19 sec.), the train covered 25·8 miles from Landover to Halethorpe at an average of 85·1 m.p.h., notwithstanding the sharp undulations on this section, which includes 7 miles up at 1 in 100-110, as well as corresponding downgrades; the highest station-to-station average was 87·7 m.p.h., and it is probable that a downhill maximum of 90 was reached. So Halethorpe, 32·9 miles, was passed in 27 min. 30 sec., and despite the cautious running necessary into Baltimore, the 40·1 miles were completed in 37 min. 13 sec., though allowed 41 min. From Baltimore a slow start was made to Biddle Street, which for one mile is up at 1 in 83, but the 33·7 miles from there to Havre de Grace were covered at an average of 79·5 m.p.h. (85·8 m.p.h. over the 16·6 miles from Middle River to Perryman), and after the 30 m.p.h. Havre de Grace service slack, an average of precisely 80·0 m.p.h. was kept up over the 28·4 miles from Perryville on to Newport, Wilmington, 68·4 miles from Baltimore, being reached in 56 min. 54 sec—a start-to-stop average of 72·1 m.p.h. and a gain of 3 min. on schedule. The Perryville-Newport section includes climbs to Bacon Hill and to Iron Hill, the first averaging 1 in 100 for 3 miles, and the second 1 in 150 for the same distance. The 25·7 miles from Wilmington to 30th Street, Philadelphia, were run in 24 min. 13 sec. (26 min. allowed), with a mean speed of 84·2 m.p.h. over the 5·1 miles from Chester to Glenolden.

Rapid Acceleration

High speed was again maintained between North Philadelphia and Newark; by an extremely rapid start Trenton, 27·9 miles, was passed in 22 min. 30 sec.; the

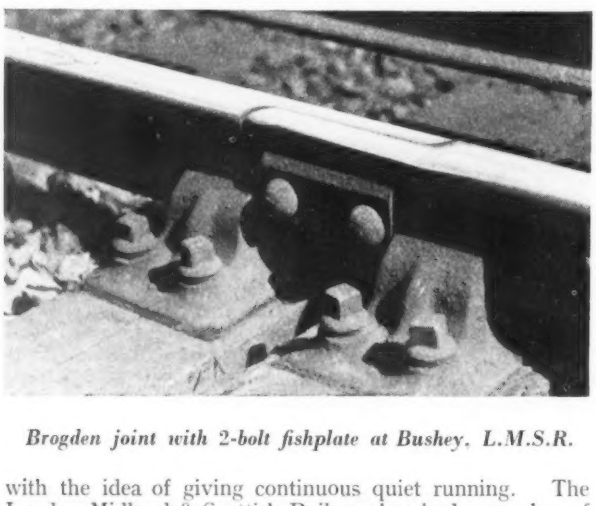
25·4 miles from there to New Brunswick were then covered at an average of 80 m.p.h., and the 42·0 miles from Trenton to South Elizabeth at 78·5 m.p.h., Newark, 76·0 miles from North Philadelphia, being reached in 60 min. 56 sec., a start-to-stop average of 74·9 m.p.h., and 3 min. inside booked time. Despite the fact that this is, between Philadelphia and New York, with little doubt the most densely-occupied main line in the world, no signal checks were experienced over its length, or, indeed on the entire journey from Washington. Gains on schedule totalled 12½ min.; the aggregate running time for the 224·7 miles from Washington to New York, including all service slacks and slowing down to and re-starting from stops, was 200½ min.; and 135 miles of the journey were run at an actual average speed of 80·3 m.p.h.

A similar journey on the Congressional was made by Mr. G. C. Wilson, with "GG1" type locomotive No. 4840, and a 12-car train of 960 tons tare and 1,000 tons gross. On this occasion it took 13¼ min. to clear Seabrook, 11·1 miles from Washington, but from there an average of 84·0 m.p.h. was maintained over the 21·7 miles to Halethorpe, and Baltimore, 40·1 miles, was reached in 36 min., start-to-stop. Eleven miles after Baltimore a bad signal check was experienced beyond Middle River, so that the 15·7 miles to Harewood Park took 17½ min., but an average of 79·5 m.p.h. was kept up over the 48·9 miles on to Newport, and Wilmington, 68·4 miles from Baltimore, was reached in 59 min. start-to-stop, or 57 min. net. Wilmington to 30th Street, Philadelphia, 25·7 miles, took 24 min. A continuation journey to New York with the Mount Vernon, a 12-car train of 900 tons tare and 940 tons full, hauled by "GG1" engine No. 4844, gave a time of 26 min. over the 27·9 miles from North Philadelphia to Trenton, start-to-stop, and from there Linden, 39·4 miles, was passed in 32¾ min., and despite a signal check Newark, 48·1 miles from Trenton, was reached in 43 min., schedule being 47 min. An average of 72·8 m.p.h. was maintained over the 29·7 miles from Princeton Junction to Linden. It is thus clear that the 2-C-C-2 locomotives of the "GG1" class can handle trains up to 1,000 tons in weight at sustained speeds of 80 m.p.h. over level track, and that despite the tightness of the timings on these Pennsylvania services, the engines have still plenty of time in hand, with the result that late running over this congested route is well-nigh unknown.

THE BROGDEN LAPPED RAIL JOINT

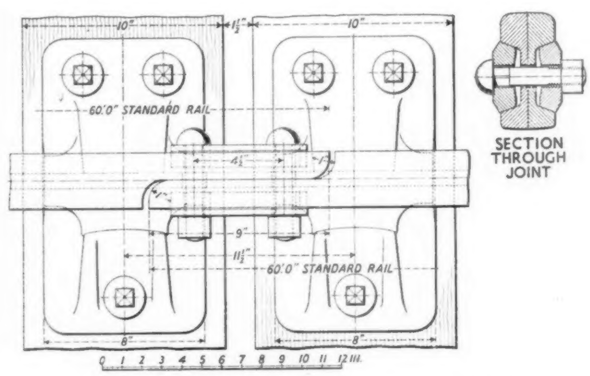
A half-lapped joint now being tested on the L.M.S.R. and adopted by London Transport. It is designed to eliminate impact and minimise noise, jolting, and wear

MANY inventions have been tried with the object of minimising the effect of the rail joint, but the Brogden half-lapped joint has so far passed the experimental stage that the London Passenger Transport Board has decided to use it to join the ends of the long welded rails that are now being installed in tube tunnels with the idea of giving continuous quiet running. The London Midland & Scottish Railway has had a number of Brogden joints in service for some time and at the present time they are installed over some 300 yd. on the up fast line between Cheddington and Tring, and for a slightly greater distance on the up electrified line near Bushey. Under both sets of conditions, *i.e.*, fast, heavy express traffic and frequent suburban electric trains, the joints are giving satisfaction.



Brogden joint with 2-bolt fishplate at Bushey, L.M.S.R.

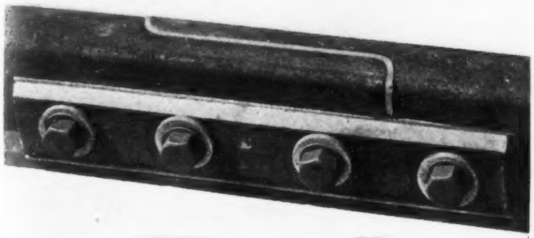
On the L.P.T.B. two experimental lengths have been in service since the early part of 1937, one in the up fast track at Dollis Hill station, and the other in the northbound track on the Northern tube line between South Wimbledon and Colliers Wood. Although both stretches carry a very heavy traffic of electric trains (on the Northern Line about 140,000 trains per annum) the condition of the joints is now very little different from what it was when they were installed new more than a year ago.



Short fishplate joint as used on the L.M.S.R.

On the L.M.S.R. a special 6-in. fishplate is used so that the joint chairs can be brought close enough together to allow the half ends of the rails to rest on them as shown in the drawing. The L.P.T.B. preferred a 4-bolt joint to the short-fishplate joint for several reasons, the principal of which was that in the tube type of track the sleepers are bedded in concrete and it is therefore not possible to place the joint sleepers very close together.

Further experiments have been carried out by the L.P.T.B. with an insulated Brogden joint, which up to date is proving satisfactory and it is expected that signal

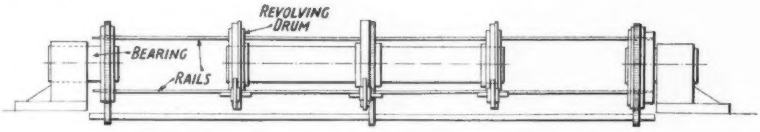


Insulated 4-bolt Brogden joint as used on the L.P.T.B.

failures due to the physical breakdown of the insulating fibres will be reduced by its use.

The question of cutting this special form of rail joint immediately comes to mind, and it is therefore of interest to mention the experimental machine which was installed at the Crewe works of the L.M.S.R., illustrated below, on which short lengths of rail ends are cut. Thirty-two ends can be cut simultaneously and the cost per rail end works out at between 3d. and 4d. A design has been developed by John Holroyd & Co. Ltd. for a machine which will cut half laps at the ends of at least 26 60-ft. rails simultaneously. As shown in the accompanying sketch, it consists of a large revolving drum at each end of which are headstocks with the turning and boring tools. The centre portion of the drum which partly carries the rails is a unit by itself and revolves on tyres and wheels. The rails are threaded through and firmly held in holes in the webs of these wheels. The centre wheel carries a gear which transmits the drive to the main shaft. The illustrations clearly indicate the principles of the Brogden joint, which can be made in different forms according to requirements.

Brogden joint with 4-bolt fishplate at Dollis Hill, L.P.T.B.



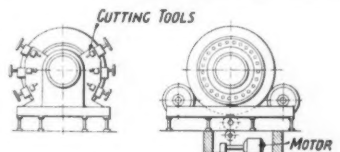
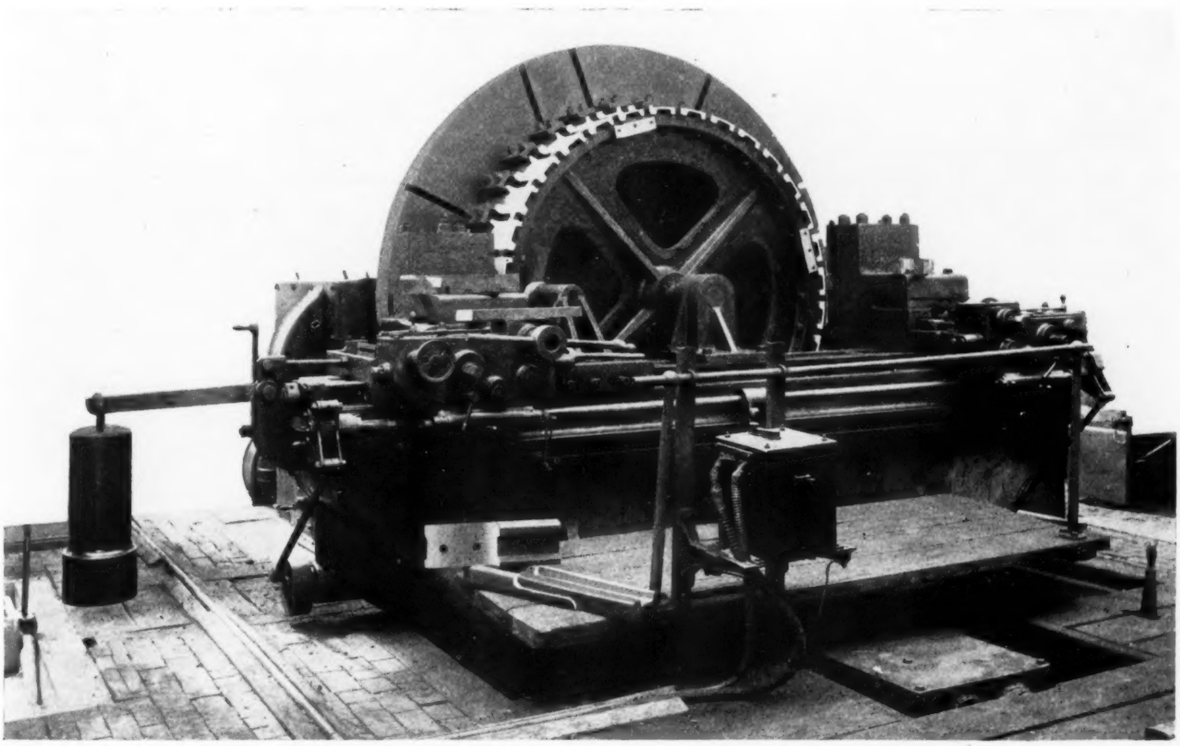


Diagram of proposed Brogden lapped rail joint cutting machine for 60-ft. rails



Experimental machine for cutting half-lapped Brogden joints

AUTOMATIC TRAIN CONTROL ON THE G.W.R.

A modified form of equipment eliminating the locomotive battery

IN our issue of April 22, page 797, we reported a demonstration trial run on the G.W.R. to show the action of the A.T.C. apparatus on an express in the event of an adverse distant signal being ignored and the enginemen incapacitated. The train, weighing 304 tons exclusive of engine and tender, and travelling at 59 m.p.h., was pulled up against the steam in 900 yd. from the A.T.C. ramp. The locomotive, *Earl of Eldon*, was fitted with the company's standard equipment, which has been in use for many years and has been very little modified since the immediate pre-war period.

As previously explained in THE RAILWAY GAZETTE, the track apparatus consists of an insulated contact ramp in the centre of the four-foot way, energised only when the distant signal to which it applies is in the " clear " position and raising a contact shoe on the locomotive as it passes over it. The raising of the shoe opens a normally closed circuit fed from a battery on the engine, so that if the signal is at " caution " and the ramp " dead " an electro-magnet holding the train-pipe valve closed is de-energised, permitting air to enter through a syren and produce a brake application; the driver resets the apparatus to normal and silences the syren as an acknowledgment of the warning. With the distant signal at " clear," however, the current picked up from the ramp actuates a polarised relay, which prevents the de-energisation of the electro-magnet and rings an electric bell as an audible " clear " indication in the cab. During the last few years

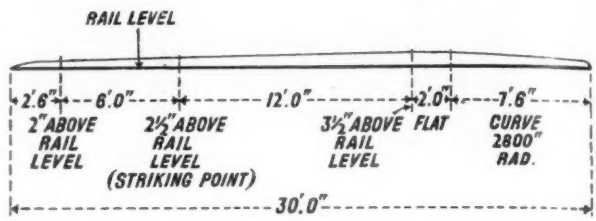


Fig. 1—Dimensions of ramp in 4-ft. way for actuating locomotive shoe

a modified type of apparatus has been applied experimentally to a few locomotives with the object of eliminating the engine battery and simplifying the electrical portion of the mechanism, the " line clear " audible signal being produced by a mechanically operated gong, provided current is picked up from the ramp.

The Component Parts

From Fig. 1 it will be seen that the ramp is sloped to give a gradual upward lift of ½ in. to the shoe in the first 6 ft., from the calculated point of engagement. As explained below ¼ in. of movement is allowed before mechanical operations in the cab begin, giving 3 ft. travel on the ramp during which the electro-magnet must operate.

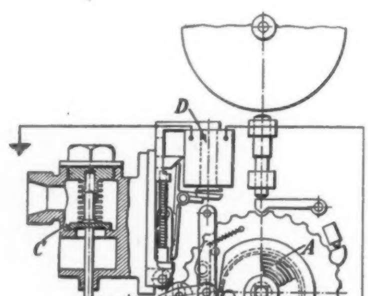


Fig. 2—Shoe in normal position. Connections with train-pipe inlet valve (including warning syren), and gong to indicate signal at " clear "

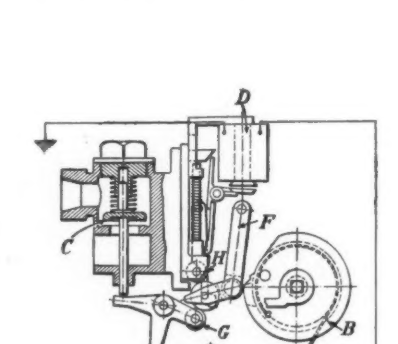


Fig. 3—Shoe on non-energised ramp (distant signal " on "), causing train-pipe valve to open and syren in the locomotive cab to sound

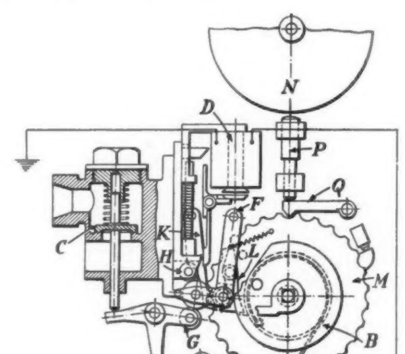


Fig. 4—Shoe on energised ramp (distant signal " off "), transmitting current to electromagnet so that train-pipe valve remains closed and " all clear " gong sounds

It will do so satisfactorily with a current impulse of $\frac{1}{60}$ sec., and as a train must be travelling 123 m.p.h. to cover 3 ft. in that interval, there is ample margin for shoe wear and to ensure efficient working. The remaining ramp dimensions have been arrived at by experience.

Figs. 2, 3, 4, and 5 show the working of the locomotive equipment. The shoe *E*, attached to the unsprung portion of the undercarriage, is coupled to the cab apparatus by a single length of No. 14 gauge wire, running in a closely wound spiral, on the Bowden brake principle, covered with several layers of insulation. It conducts the current picked up from the ramp to the electromagnet *D* and imparts motion to drum *B*, which is under the action

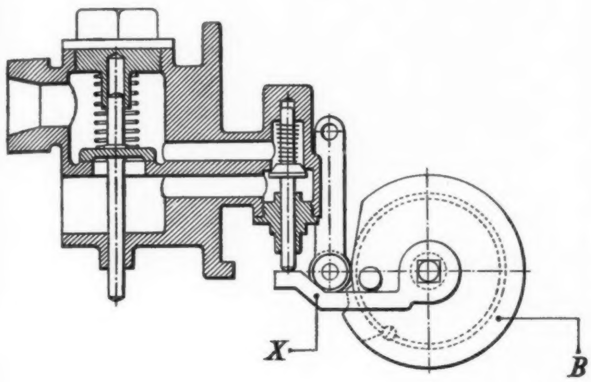


Fig. 5—Details of train-pipe valve and secondary detector valve

of spring *A*. This spring tends to rotate the drum counter-clockwise, but a fixed stop keeps the latter in the position seen in Fig. 2. In this condition the main inlet valve *C*, to the train pipe, is kept closed by a spiral spring, and a secondary detector valve (Fig. 5) is held closed by a small lever. The air inlet to this valve includes a small whistle, so that all parts are detected normal before and during running, because if they were not so this whistle would blow continuously.

Fig. 3 shows the action when a locomotive passes a non-energised ramp, the distant signal then being at "caution." The shoe *E* is raised, rotating barrel *B* against spring *A* (Fig. 2) until its inclined surface engages lever *F*, increasing the distance between *G* and *H*. As the electromagnet *D* is not energised, *H* cannot rise, so that *G* is forced downwards, opening valve *C* and latching on the resetting handle *J*. The air entering the train pipe through valve *C* sounds the warning syren, which ceases when the driver operates handle *J* after the ramp has been passed, and drum *B* having then returned to normal under the action of spring *A*, valve *C* is reclosed. The apparatus can, of course, be adapted to other types of brake besides the vacuum.

If the distant signal is at "clear" the action is as seen in Fig. 4. Drum *B* is rotated as before but electromagnet *D* is energised directly contact is made with the ramp, as switch *Y* in the control circuit is closed. The preliminary $\frac{1}{4}$ in. shoe movement, mentioned above, allows magnet *D* to be energised quickly enough to accommodate the fastest train and move the projection on its armature out of the way of *H*. The latter therefore moves up when *B* is rotated, leaving *G* unaffected, valve *C* closed, and pushing lever *K* over to engage with catch *L* on the notched disc *M*, which thus rotates with *B*. Lever *Q* causes hammer *P* to give a series of blows on gong *N* during the forward and return motion of *M*, forming the audible "clear" signal. The detector valve is also opened for a brief interval and will remain open should any part fail to return to normal when the ramp has been passed.

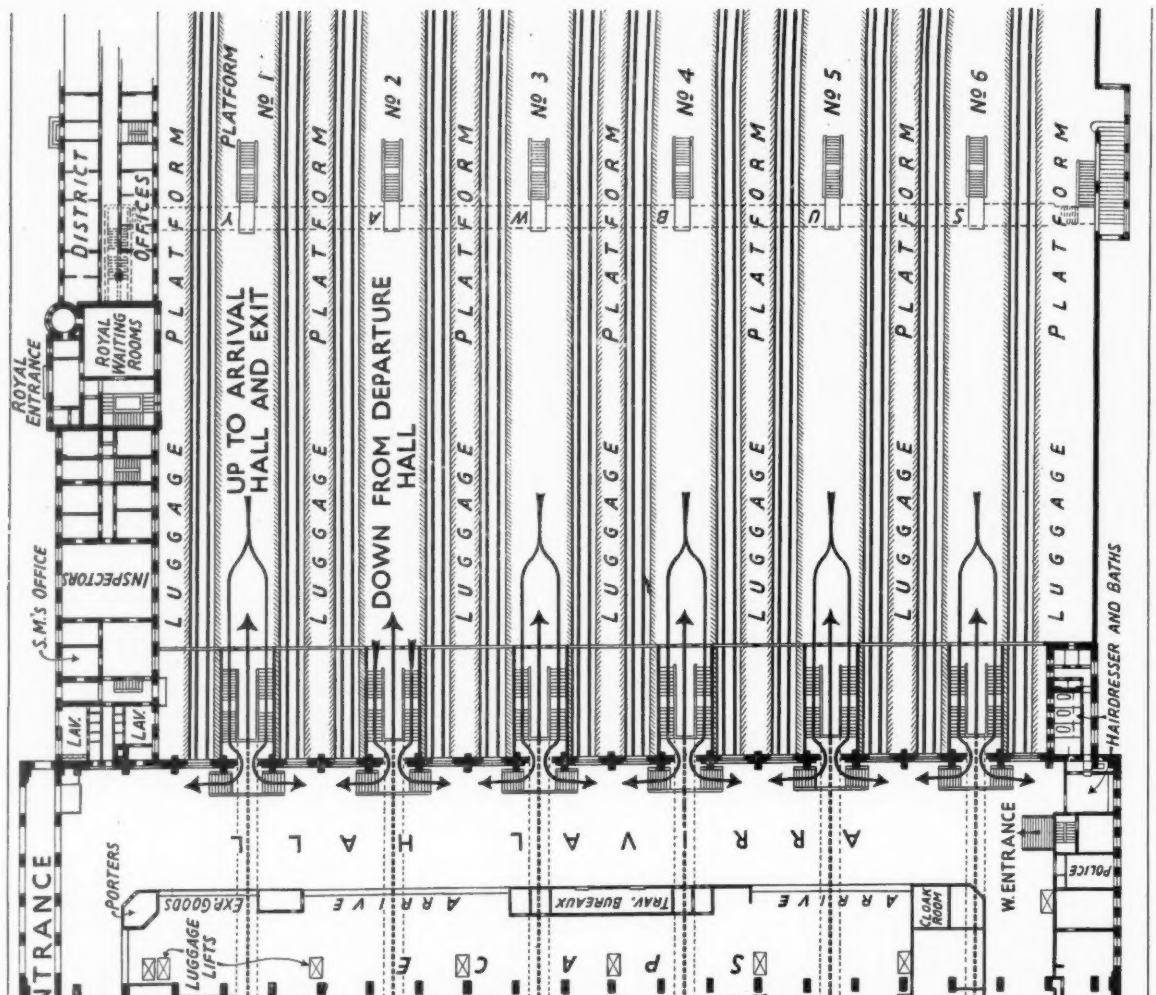
The entire design is based on fundamental safety principles and its reliability has been established by more than four years of experimental running under actual service conditions. It has functioned perfectly at speeds of over 90 m.p.h. on the Cheltenham Flyer and other high-speed trains. For normal double-line working the apparatus is not polarised, but in conjunction with polarised relays can be used on single lines or in association with three-aspect signalling. It is constructed under Brooker's patent No. 327281 of 1929, and Tyer and Brooker's patent No. 416652 of 1934, and the sole manufacturing rights for railways other than the Great Western are held by Tyer & Co. Ltd., of Dalston, London.

Sir Nigel Gresley: Some South African Impressions

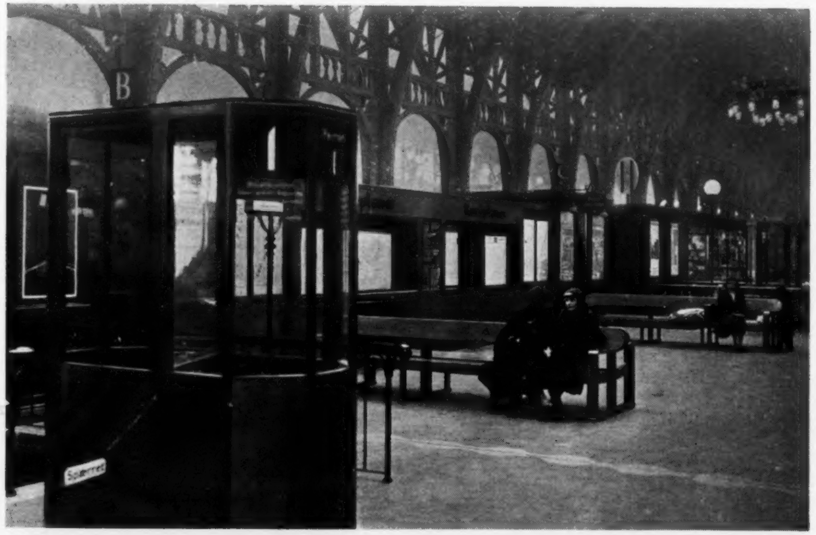
During a three weeks' visit to South Africa earlier this year, Sir Nigel Gresley, Chief Mechanical Engineer of the L.N.E.R., travelled 4,000 miles on the railways of the dominion. A private saloon coach was placed at his disposal, but he took the opportunity of studying the accommodation for the ordinary passenger, and also riding many miles on an electric locomotive working a 1,000-ton coal train over falling grades of 1 in 50.

Some impressions gained during this South African visit are presented by Sir Nigel in the June issue of the *London & North Eastern Railway Magazine*. While making certain comparisons with conditions on British railways, the author emphasises the limitations imposed upon maximum speed by the South African 3-ft. 6-in. gauge. This does not prevent rolling stock being built to a loading gauge as wide and high as in Great Britain, which is fortunate from the point of view of the passenger who has to spend long periods in the train. As an example of the distances and times of rail journeys between large centres, Sir Nigel Gresley's own itinerary may be quoted. From Cape Town he travelled to Bulawayo, through Kimberley and Mafeking, a journey lasting 47 hr.; the run from Bulawayo to Johannesburg took 27 hr., and then he went on to Pretoria. From Pretoria to Ladysmith took 12 hr. and then another day and a half were spent on the run to Durban over the electrified section of the Natal Railways. From Durban he travelled back to Johannesburg by night through a violent South African thunderstorm, in 19 hr., and the final journey from Johannesburg to Cape Town occupied two nights and one day, about 35 hr. In all, seven nights were spent in the train.

First class sleeping cars on the Cape Town—Johannesburg crack trains are, Sir Nigel thinks, but little better in their accommodation than the third class sleepers on Scottish expresses in this country, while the general standard of comfort on ordinary services is not to be compared with our own. But—an important point on long journeys—a day's meals (breakfast, lunch, tea, and dinner) may be had in the dining cars for only 8s. 6d.



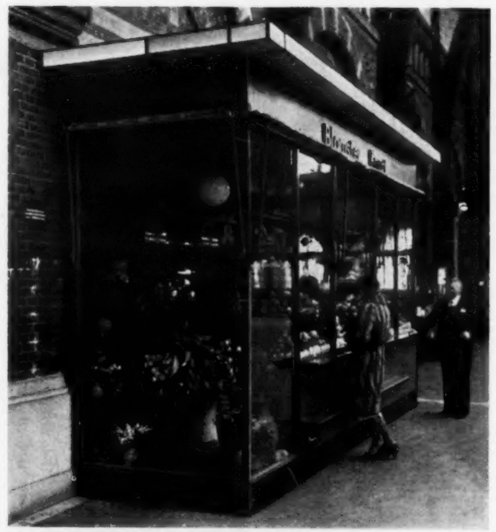
Copenhagen Central station, Danish State Railways. General arrangement plan of booking hall, circulating area and platforms, showing non-conflicting paths of passengers and luggage from and to platforms



A ticket collector's booth, seats, and timesheets

The café in the departure hall of the circulating area

Entrance to station cinema



Fruit and flower stall

Copenhagen Central Station, Danish State Railways

(See article on page 1110)

COPENHAGEN CENTRAL STATION

The principal station of the Danish State Railways is an example of thoughtful convenience in which the paths of incoming and outgoing passengers are non-conflicting

COPENHAGEN Central station is a model of convenience from both the train operating point of view and that of the passenger. The station is a through one, with train marshalling yards at each end, so that arriving trains are taken out by the main-line engine as soon as they are emptied; and departing trains similarly need occupy the platforms only for just as long as may be necessary to load them. Shunting is thus reduced to a minimum. The platforms are below street level and, as the plans shows, are reached from a well-arranged and spacious concourse by stairways, separate for entry and exit. Between the running lines serving the passenger platforms are lower platforms for luggage, after the style now commonly found in the most modern stations on the Continent. From these luggage from the trains is conveyed by lifts to a big luggage space with a long, low corridor, in the concourse, and the claiming of trunks and cases is thus simplified.

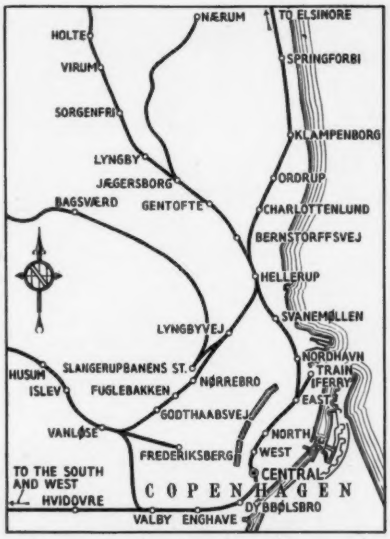
A high arched wooden roof, painted dark red and cream, covers the concourse in which nothing that could minister to the traveller's wants seems to have been forgotten. At one corner there is an attractive café; near another a

(See also illustrations on pages 1108-9)

Departure side of circulating area showing stairs down to platforms. Note the S in the right foreground indicating electrified suburban services

Arrival side of circulating area showing ticket collectors' booths, stairways from platforms, and luggage concourse

soda fountain dispenses anything from ice cream to hot soup. Fruit, newspaper and other kiosks, writing places, a post office, conveniently displayed plans of the town, timetables, train arrival and departure lists, and drinking water fountains are other amenities for the convenience of the traveller. Adjacent are the booking hall, travel bureau, a cinema, lavatories, and a fine restaurant.



Key map showing the railways of Copenhagen

The Burlington's 112-mile C.T.C. Installation

One of the outstanding U.S.A. signal installations of 1937 was the C.T.C. equipment between Denver and Akron, 112 miles, covering an entire sub-division of the western main single line of the Chicago, Burlington and Quincy Railroad; this involved 19 passing loops, and forms the largest C.T.C. installation in the world. An interesting feature is the second track diagram, above the operating one, marked with the capacity of each loop and distance to the next for the guidance of the despatcher, stationed at Brush. This section of line has been controlled by absolute-permissive automatic signalling since 1914, the second installation the company had. The first was in 1911, from Cameron to near Murray on the Kansas City line, 44 miles, and both used interlocking, instead of stick, relays to effect the directional selection, on a circuit designed by the present Signal Engineer, Mr. W. F. Zane and his assistant, Mr. T. C. Seifert. The Burlington has always enjoyed an excellent reputation for safety, of which its first Signal Engineer, the late Mr. J. B. Latimer, who was appointed in 1903 and died in 1926, was justifiably proud. For a time it had less automatic signalling than some other American lines, having in 1910 only 42 route miles fitted, none single track, but its telegraph block and lock-and-block systems were admirably organised and gave most satisfactory results.

When the 8-hour day came in automatic signalling proved more economical and it was thereafter progressively extended, at first with two-position lower quadrant semaphores—to which the company remained faithful in spite of the popularity of the 3-position type with other lines—and later with light signals. On December 21, 1927, automatic signalling was complete throughout the Chicago—Denver line, over which the Zephyr trains now run, a distance of 1,034 miles. On some double-track sections both lines are signalled for traffic in either direction, an arrangement previously used with manual block, and the centre track of some three-track sections has A.P.B. control.

Historic Canadian Locomotives

Right: Arrival on July 4, 1886, at Port Moody of the first Canadian transcontinental passenger train. The C.P.R. lines had met at Craigellachie on November 7, 1885, but work was then suspended during the winter

Left: The "Adam Brown," one of the first locomotives of the Wellington, Gray, & Bruce Railway (Hamilton, Ont., to Southampton). It was named after the President of the railway, the father of Sir George McLaren Brown, until last year European General Manager of the C.P.R. The "Adam Brown" hauled the first train between Guelph and Elora on July 1, 1870

BEHAVIOUR OF VEHICLES ON RAILS

A description of the Amsler apparatus for measuring the movement of wheels in relation to rails on curves, and of tests carried out with it in Switzerland, leading to the adoption of a Liechty steering device

By ADOLPHE M. HUG, M.I.Mech.E., Dipl.Ing.

FOR free rolling movement a pair of railway vehicle wheels must take a course at right angles to its axis, and on a curve this course must be tangential. As, however, the axles of a four-wheel or six-wheel vehicle, or of a bogie truck, are normally parallel to one another, it follows that on a curve both (or all three) cannot move tangentially, and the wheel flanges, being forced against the rail, produce considerable wear both in themselves and in the rail. The first illustration — a section of wheel tyre and rail—shows the wear produced on both, due to the fact that the contact between the two bearing faces has taken place not along a narrow width of the tread, but at two points *A* (the point of support) and *a* (the bearing point of the flange). The instantaneous axis of rotation of the resulting movement of the wheel has, in fact, passed neither through *A* nor *a*, so that slipping has been enforced, producing friction and wear. A marked reduction of such loss of power and material can be effected by the automatic steering of the axles, and this also improves the running of the vehicle.

Fig. 1—Section through worn rail and tyre, taken from one of the cars described, before modification

The support of the Swiss Foundation for Public Economy, and of various private railway companies, has made it possible to carry out systematic tests with railway trucks of different types,* the apparatus for which was designed and constructed by Alfred J. Amsler & Company, of Schaffhouse (Switzerland).

The problem was to determine the relative positions of the wheel, the rail and the body of the carriage when passing over irregularities in the track. This had been attempted several years earlier by taking cinematographic pictures, but no satisfactory results had been obtained, owing to the smallness of the angles and displacements which had to be considered and the shortness of the intervals of time of the exposures.

Figs. 2, 3 and 4 represent the new measuring device in principle and as constructed. The main part is a horizontal frame of rolled-steel sections, strengthened by means of diagonal timber bracing, which entirely surrounds a pair of wheels. This frame is suspended on pivots placed in the heads of the axle trunnions and is kept parallel to the rails by means of a system of rods and parallel cranks. With the exception of this parallel guiding it is entirely free to describe with the axle—with which it forms a unit—any movement relative to the carriage body. Three feelers (I, II and III, Fig. 4) pivoted to this frame are pressed by springs against the gauge faces of the rails and serve to determine the relative movements of the frame, *i.e.*, of the wheels, relative to the rails. The location and support of the measuring frame ensures the correct guidance of the feelers on the track and fixed positions of their pivoting axes relatively to the axle.

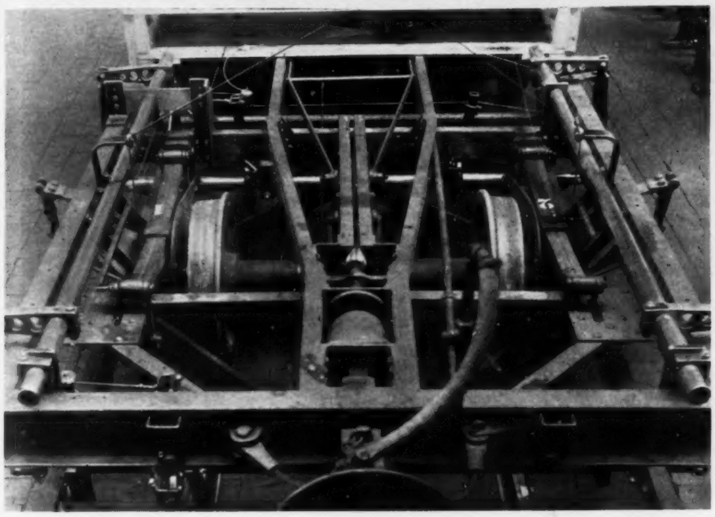
As will be seen from Fig. 4, a movement is imparted to wire 2 inversely as feeler I, and directly as feeler II, move relatively to the frame, and the wire therefore registers mechanically the absolute difference of the angular movements of the two feelers, which difference is proportional to the trigonometric tangent of the angle between the plane of the wheel and the rail. The difference thus registered is transmitted directly to the recording apparatus by means of a Bowden wire, the other end of the tube of which butts against the frame of the vehicle under test and thus eliminates the parasitic influence of the relative movement between it and the feelers.

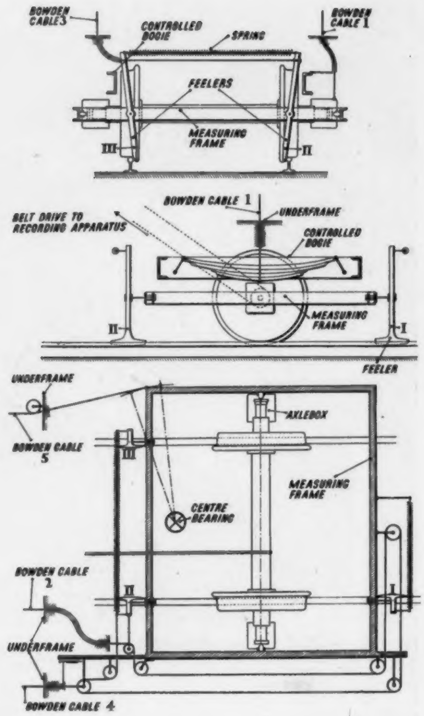
The Bowden cable 3, actuated by the movements of feelers II and III mounted opposite to each other, measures the width of gauge of the rails under the vehicle. A Bowden wire 4 is attached to a pulley over which runs a cable connected to the feelers I and II, this pulley being carried from the frame by a long lever. This system records the average of the angular displacements of the two feelers in contact with the same rail relatively to the frame, in other words, the distance between the plane of the wheels and the rail in question. On curves it is necessary to deduct from this record an amount to allow for the deflection of the rail between the two feelers. This slight correction presupposes, of course, that the curvature of the rail at this spot is known.

Other cables serve to record the relative movements between the measuring axle and the vehicle underframe. Cable 5, for instance, indicates the angular displacement of the axle with regard to the underframe, whilst cables such as 1 record the deflection of the laminated springs relatively to the bogie as a measurement of the individual load on the wheels. Between the bogie and underframe cables 1 pass through Bowden tubes. In consequence of the internal friction of the leaf springs, this method includes certain errors, but in spite of this the method was adopted on account of its simplicity and because it affords indications of the major increases and decreases of load.

For all cable transmissions 2 mm. (about $\frac{1}{13}$ in.) torsion-free steel cables were used, and all the pulleys rotate on ball bearings and are enclosed in dust-proof housings. The ends of the metal hose or sheath of the Bowden systems are soldered to the respective pulley housings; Fig. 3 shows how the cables are led. The layout had to be arranged with great care so as to prevent as far as possible all friction, and in such a way that the initial tension in all the cable lines as well as in the counter-springs was not too high.

* The full reports of these researches have been published by Herr R. Liechty and are entitled "Messungen über die Spurführung bogenläufiger Eisenbahnfahrzeuge," Berne, 1936





Figs. 2 and 3 (left)—Experimental truck with the Amsler measuring device

Fig. 4 (above)—Layout diagram of the Amsler measuring device

All the measured values are recorded on a paper strip 600 mm. wide, moved forward as a function of the distance travelled by means of a flexible shaft driven by the axle. The recording apparatus is shown on a larger scale in Fig. 5. To mark special sections travelled over or peculiarities of the track, the recorder is provided with a hand-operated trigger stylo. In order that the apparatus may be applied to different vehicles, the measuring frame and its guides are made extensible both longitudinally and transversely by rods and cranks, and the feelers are also adjustable. This measuring arrangement has amply fulfilled expectations and has enabled extensive experimental results to be compiled.

One of the most instructive experiments was obtained on electric railcar CFe 2/6 No. 785 of the Berne-Loetschberg-Simplon Railway. This coach consists of a motor unit with 1B wheel arrangement (it is half of a standard electric locomotive) and a carriage unit with a floating intermediate carrying axle and a four-wheel bogie at the rear (Fig. 6). The two units are so connected that on curves the motor unit takes up compulsorily the direction of the coach. The floating intermediate axle, which is close to the motor unit, originally had a lateral play of 2 × 50 mm. (2 × 2 in.) for the 10·750 m. (35 ft. 3$\frac{1}{4}$ in.) wheelbase. This car, before the investigations, had been in service between tyre renewals, *i.e.*, up to a wear of 8 mm. (about $\frac{1}{3}$ in.) of the tyre diameter, some 30,000 km. (19,000 miles) between Berne and Schwarzenburg which has many 180 m. (9-ch.) curves. The fixing up of the measuring arrangement to the intermediate carrying axle of this electric railcar is shown in Fig. 7.

The diagrams in Figs. 8 and 9 show the behaviour on curves of the floating axle as originally built, and Fig. 10 as subsequently altered, (*a*) when the motor unit is leading and (*b*) when it is trailing (pushing). As originally built, in (*c*) the axle leads at the outer rail with an angularity

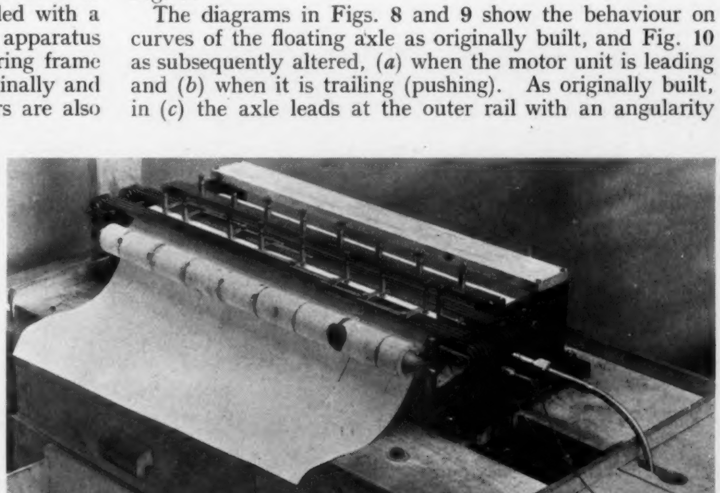


Fig. 5—Recorder of Amsler device on the experimental truck

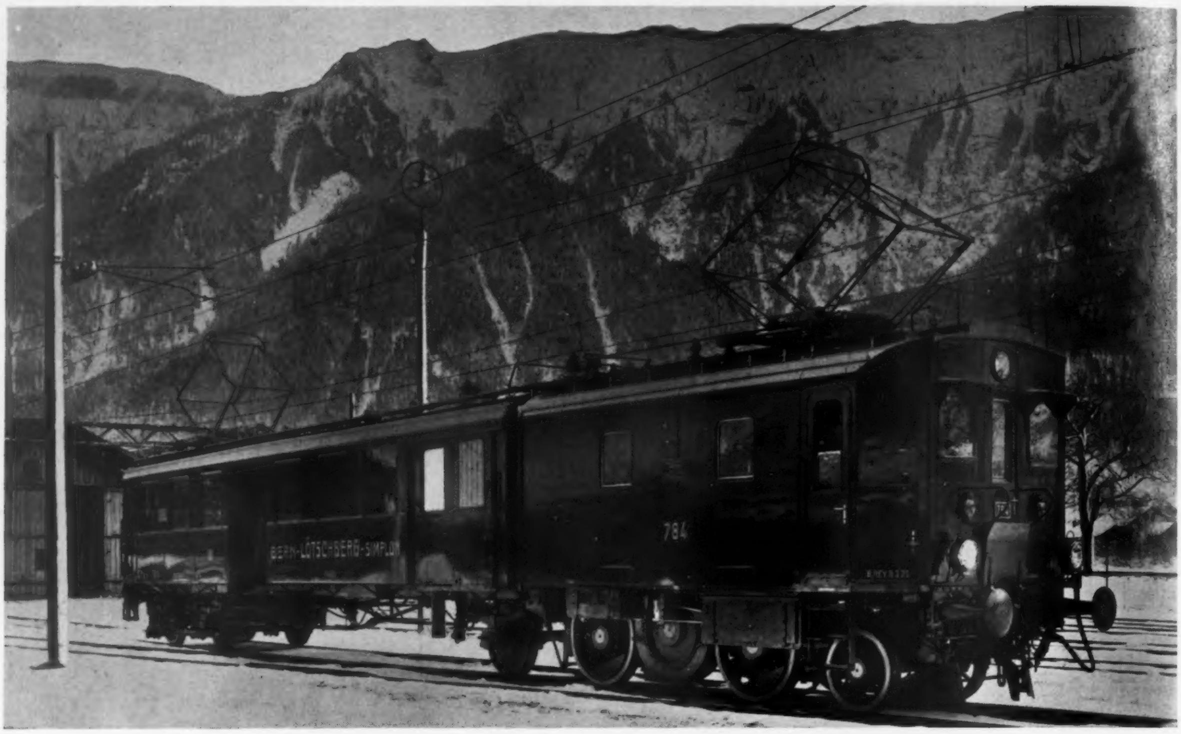


Fig. 6—Articulated electric motor coach with the Liechty controlled single-axle bogie, Lötschberg Railway

of 1 deg. 30 min., and in (*b*) it leads at the inner rail with an angularity of 1 deg. 55 min. The angular displacement occurs in jerks at the beginning and end of each curve, these jerks being communicated through the lateral controlling springs to the underframe and body.

The points of contact between wheel and rail were determined graphically from the known profiles of rail and tyre and the measured angles of incidence or striking of the flanges. Chalk marks were applied to the flanges and the rails for subsequent verification, and the paths travelled by the wheels during a complete revolution were measured so that the magnitude and direction of the slipping which took place at the points of contact on the rails were known. The results obtained are shown in the following table:—

Trial	Outer rail of curve: Tyre diameter	Outer rail of curve: Distance travelled/π	Inner rail of curve: Tyre diameter	Inner rail of curve: Distance travelled/π
Fig. 8	1,017·0 mm.	1,020·0 mm.	1,013·9 mm.	1,010·8 mm.
Fig. 9	1,013·0 mm.	1,021·8 mm.	1,017·9 mm.	1,013·6 mm.
Fig. 10	1,009·0 mm.	1,010·5 mm.	1,006·0 mm.	1,002·6 mm.

Trial	Diameter at bearing point of flange	Vertical distance between bearing points of tyre on rail table and of flange against side of rail-head
Fig. 8	1,040·0 mm.	10·65 mm.
Fig. 9	1,044·0 mm.	11·80 mm.
Fig. 10	—	—

Fig. 7—Amsler measuring device mounted on the carrying axle of the car shown in Fig. 6

The specific resistance of a vehicle on a curve depends upon the frictional energy expended at the points of contact between wheels and rails, and this is determined by the loads on the contacts and the velocities of slip. The data obtained in the course of the present investigations, applied to Professor Heumann's conditions for static equilibrium,* showed that, as originally built, the normal pressure at the flange, on a 188 m. (617-ft.) radius curve, and with a flange inclination of 70 deg., is 40 per cent. of the wheel load. The vertical component is about 22 per cent., *i.e.*, this proportion of the wheel load is supported at the point of contact of the flange. With a coefficient of friction of 0·2, the "curve resistance" is 7·54 kg. per *tonne* (16·9 lb. per ton) for the case represented by Fig. 8, and 10·85 kg. per *tonne* (24·3 lb. per ton) for that represented by Fig. 9. From this it

* See *Organ für die Fortschritte des Eisenbahnswesens*, December, 1934

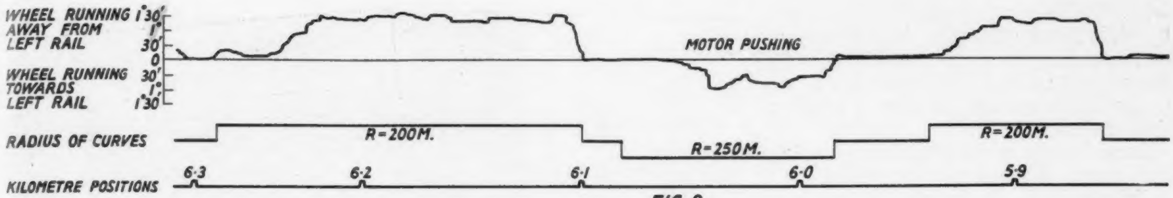


FIG. 8

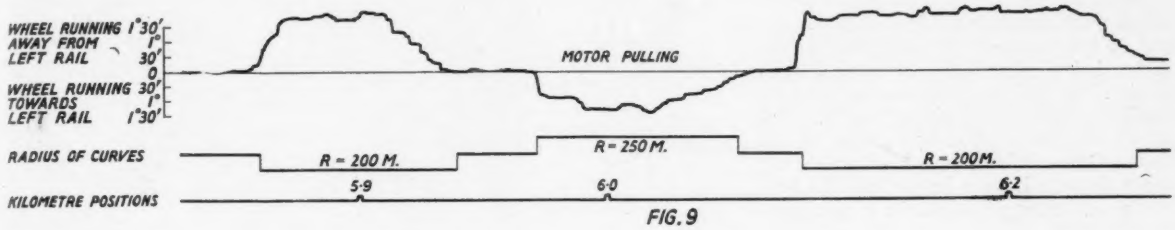


FIG. 9

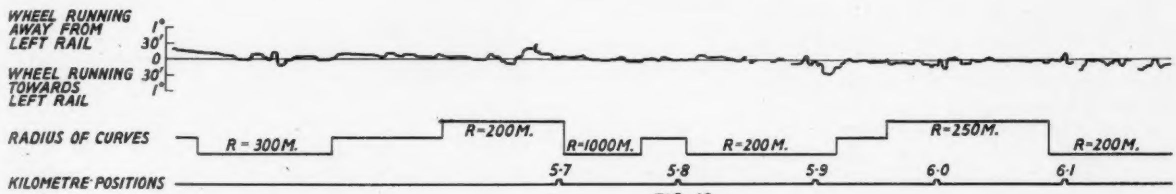


FIG. 10

Figs. 8, 9, and 10—Diagrams taken on the Lötschberg electric motor coach showing deflection from right-angle between axle and rail, before and after modifications. (Figs. 8 and 9, before modification, show conditions with motor pulling and pushing respectively)

will be seen that the "inside incidence" (of the flanges on the rails) considerably increases the resistance on curves. The energy expended at the flanges amounts to about 40 per cent. of the total resistance which has to be overcome on curves, and is of crucial importance as regards the life of tyres and outer rails.

In order to reduce the heavy wear on the flanges observed in practice, it was decided to apply radial steering to the axle, thus bringing the point of contact of the flange into the meridian plane of the wheel, reducing longitudinal slipping and eliminating transverse slipping. On the basis of the angles between wheel and rail, and between engine and carriage units of the railcar as determined during the trials, the Liechty controlled single-axle bogie has been designed.* Fig. 10 shows this type of controlled radial bogie as constructed for these railcars. It pivots at *A* on the centre line of the motor unit and is jointed at *B* to the carriage unit by means of a directing pivot longitudinally displaceable in the radial truck. The original articulated connection between the two units is retained at *C*. The control of the radial axle takes place as a function of the angle established in curves between the two units, which angle is proportional to the radius of the curve. In view of the long wheelbase of the two parts of the railcar exact guiding of the controlled axle is ensured on curves as well as on the straight.

By means of this very simple modification, a radial orientation of the controlled single-axle bogie is obtained, for all the curves, as indicated in Fig. 11 and the table above. The remaining friction of the flanges, which is very much reduced, serves to guide the vehicle, and what remains of the resistance in curves can be attributed to insufficient coning of the tyres. The resistance on curves has thus been reduced to 0·74 kg. per *tonne* (1·66 lb. per ton), *i.e.* to but 7 to 10 per cent. of the previous value. After a further travel of 110,000 km. (69,000 miles) of the altered coach on the same section of the line and under the same conditions, the flange wear was but 1 mm., *i.e.*, only about 7 per cent. of the former wear.

The measuring equipment described is also suitable for the observation of varying conditions on curves, which conditions cannot be calculated by the methods hitherto available. The Amsler equipment was also fitted to an old Klose-type six-wheel vehicle in use on the narrow-gauge St. Gall-Appenzell Railway. In this design, the end axles are steered on curves by the laterally displaceable centre axle.

The graph obtained showed that the angle between wheel and rail averaged zero for the complete curve, but its instantaneous values fluctuated widely and alternated in sign. The leading wheel was shown to hunt, and the movement of the controlled axle relatively to the underframe oscillated accordingly. The records obtained for the front and rear axles showed opposed hunting of the two axles. The reason for this is as follows:—

On entering a curve, there is at first no steering of the axles; the leading wheels hug the outer rail, and the trailing wheels the inner rail. The centre wheels, having initially a positive angle of incidence, also hug the outer rail and experience a transverse displacement, causing them to realign the steered axles. Owing, however, to the clearance between flanges and rails, the steering effect thus produced is too great, and the leading wheels begin to move away from the outer rail. Directly the angle of incidence of the centre wheels is thus made negative, these wheels move across the track clearance, hug the inner rail and reduce the steering of the other axles so that the original condition is restored. The movement is thus determined by the track clearance and is continually effected by the centre axle. Completely stable guidance on curves is, therefore, impossible with vehicles of this

* The Liechty system of steerable axles was described in *The Railway Engineer* of October, 1931, pp. 375–377

type. Stable running can be effected only by deflections somewhat less than those corresponding to strictly radial control of the steered axles. This applies not only to the Klose system but also to others of similar design.

Experiments with a two-axle truck of the same dimensions but fitted with radially-guided single-axle bogies constructed on the Liechty system, showed much more accurate control of the axles, and no hunting, such disturbances as were shown being due mainly to track irregularities. The resistance on curves was very small because of the almost radial guiding of the axles. But even with the old three-axle truck built on the Klose system, the resistance is very low, the end wheel sets never bearing on the rails at an appreciable angle.

Summing up, it can be said that the trials have confirmed the theory of the behaviour on curves established by Prof. Heumann, and form a basis of great value for the development of a technically and economically perfect construction of railway vehicles. Also it must be remembered that a reduction of flange friction may be expected to reduce the wear of the rails. Finally, the elimination of great deflecting forces between flanges and rails considerably reduces the stressing of the track at places of unequal elasticity (rail joints, &c.) and allows of a truer maintenance of the gauge and alignment, all points which make for the smoother running of vehicles.

(*See editorial comment on page* 1095)

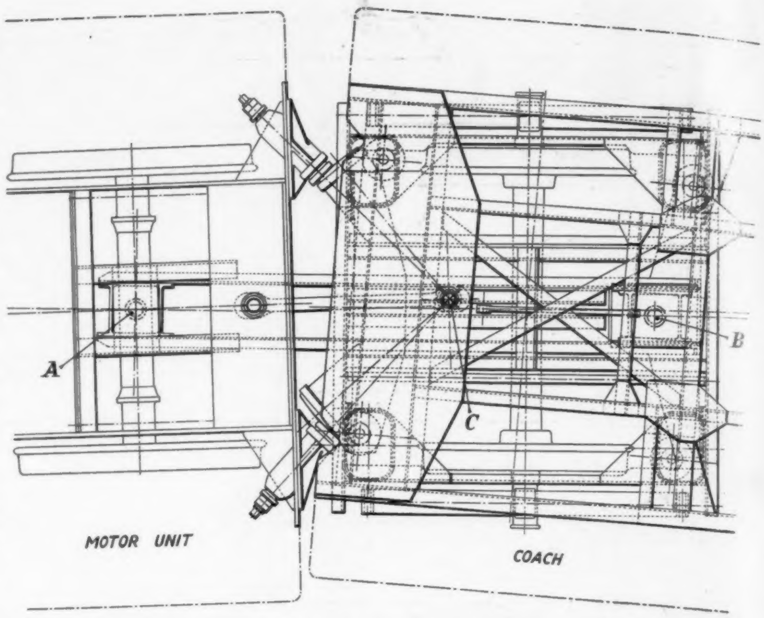
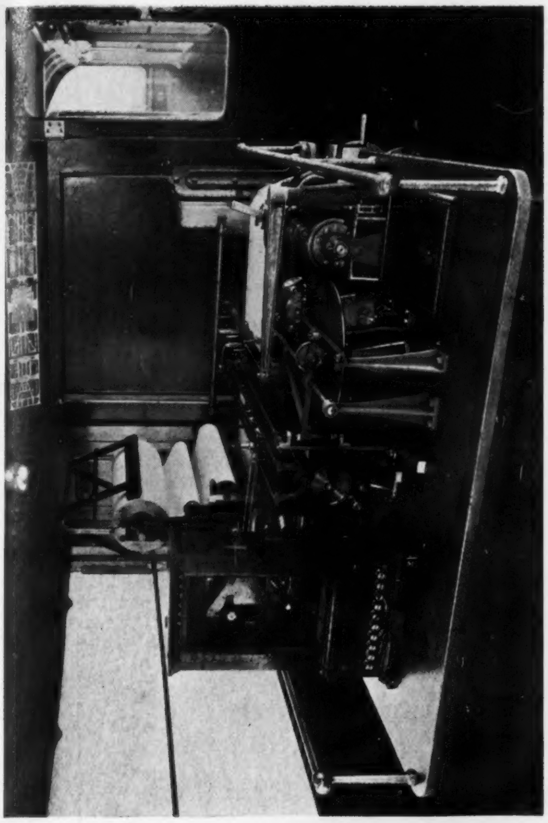
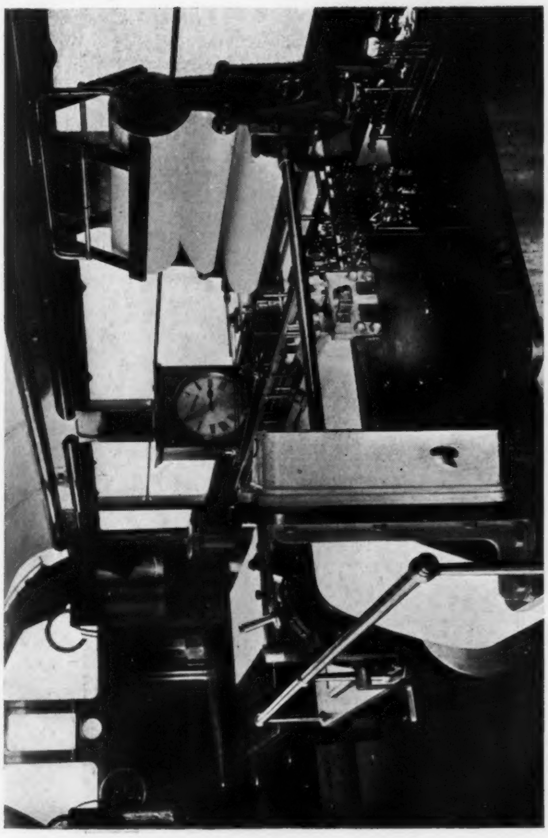


Fig. 11—Connection between motor unit and carriage of the Lötschberg electric motor coach, Fig. 6, as fitted with Liechty axle control

A view taken about 1870 of Shackerstone station, junction for Coalville on the Midland & L.N.W.R. Nuneaton—Burton joint line. Both routes are now closed to passenger traffic





Two views of the instrument table showing recording paper passing under pens, and electric clock

L.M.S.R. DYNAMOMETER CAR

This vehicle was attached to the special train from Euston to Glasgow for the Institution of Locomotive Engineers summer meeting on June 8

THE L.M.S.R. dynamometer car illustrated was attached to the special train for the Institution of Locomotive Engineers summer meeting on June 8. The car is 50 ft. 0 in. long, and weighs 33 tons. It contains an instrument room 26 ft. 6 in. long at the front end, followed in order by a standard passenger compartment with table, a small kitchen, lavatory, and store room. The dynamometer itself is of the spring type and two things in particular were aimed at in the design; first, that the car should be as readily coupled as ordinary stock and with the same kind of coupling; and secondly, that push as well as pull be recorded and that these indications must be on buffers and drawbar respectively. This was achieved by duplicating the springs and building into the underframe a strong cross girder which serves as an anchorage for the pull spring in front and the push spring behind. With all plates coupled together, the pull spring gives a 6-in. deflection with a maximum of 18 tons, and the push spring a 6-in. deflection with 14 tons. By coupling or uncoupling different numbers of plates, both springs can be altered in strength to suit different conditions of running, and when required can be adjusted to give 6 in. deflection with any load between 2 tons and maximum by 2-ton increments.

Rigidly bolted to the cross girder referred to above, is the instrument table; and an arrangement of collared rods attached to the buckles of the push and pull springs actuates the drawbar pen on the table which records the pull and push on either side of a datum line. The recording paper is 20 in. wide and has 6 rates of travel, 6 in., 1 ft., 2 ft., 5 ft., 10 ft., and 20-ft., a mile, and changes of speed can be made while running if required. For normal testing a travel of 6 in. a mile is used.

The travel of the paper and all elements connected with the speed of the car are derived from a separate flangeless roadwheel which is situated between the running wheels on one side of the leading bogie. This wheel is 33·6 in. diameter, so as to give exactly 600 revolutions a mile, and can be raised and lowered at will by a screw and handle inside the car. The roadwheel is thus in contact with the rail only during an actual test and wear is thus reduced to a minimum. Bevel gearing and shafts fitted with universal joints transfer the motion to the table, where besides driving the paper it drives the speed recorder integrator disc, and mileage recorder.

An electric clock is mounted on the table and is fitted with a number of contacts which mark every two seconds on the chart and in addition actuate the time element in the speed recorder through suitable relays.

The integrator is of the usual type in which a small friction wheel is moved by the drawbar across a disc rotated by the road wheel, thus combining the effect of pull exerted and rate of travel into units of work done. This is recorded on a counter and is also transferred to the chart by the reciprocations of a pen holder, so that a series of peaks are drawn on the paper each one chalking up as it were so many units of work done—actually 50 h.p. min. per pair of spring plates.

In addition pens are provided for operation from the footplate; or for recording stations or other features from the car; and there is also a pendulum ergometer which is used in work on vehicle resistance to record the work done by accelerating and decelerating forces. Water

consumption on the engine is indicated in the car by a simple U-tube gauge which gives an instantaneous reading of the level of water in the tender tank.

In 1929 the car was partly rebuilt at Derby and had the whole of its drawgear mounted on ball-bearing rollers, so that the friction was reduced to a negligible amount. At the same time a special testing machine was built which could be bolted to the buffer beam, and by attaching weights to the end of a long lever, actual pulls up to the maximum could be exerted on the drawbar.

This car has been in continuous use ever since the formation of the L.M.S.R., and it has played a considerable part in the improvement in efficiency of L.M.S.R. locomotives during that period.

NEW 4-6-2 TYPE EXPRESS LOCOMOTIVES, L.M.S.R.

Streamlined and non-streamlined types based on the successful "Princess Coronation" class

As announced in our issue of May 13 last, ten more express locomotives of the four-cylinder 4-6-2 type are being built at the Crewe works of the London Midland & Scottish Railway to the designs of Mr. W. A. Stanier, Chief Mechanical Engineer. Five of them are being streamlined, and the remainder built in non-streamlined form. For the convenience of readers, the names and numbers are repeated herewith:—

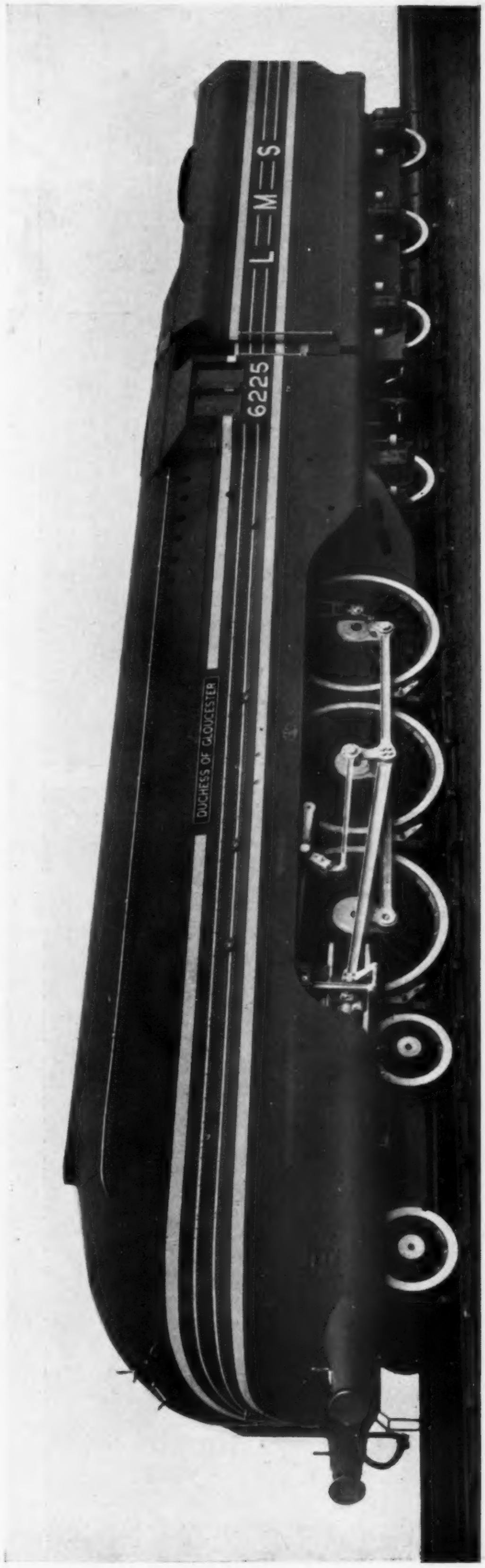
	Streamlined Engines
6225	*Duchess of Gloucester*
6226	*Duchess of Norfolk*
6227	*Duchess of Devonshire*
6228	*Duchess of Rutland*
6229	*Duchess of Hamilton*
	Non-Streamlined Engines
6230	*Duchess of Buccleuch*
6231	*Duchess of Atholl*
6232	*Duchess of Montrose*
6233	*Duchess of Sutherland*
6234	*Duchess of Abercorn*

Variations in design from the original *Coronation* locomotive, of which a detailed and fully illustrated description appeared in our issue of May 28, 1937, are of a very minor nature. The special measures taken to reduce weight in the earlier series of streamlined engines were the subject of a two-part article published in our issues of February 18 and 25 this year, and since reprinted in book form. The use of nickel-molybdenum steels for reciprocating parts and of nickel steel for the boilers will be recalled. Similar measures have been adopted in the construction of the present locomotives.

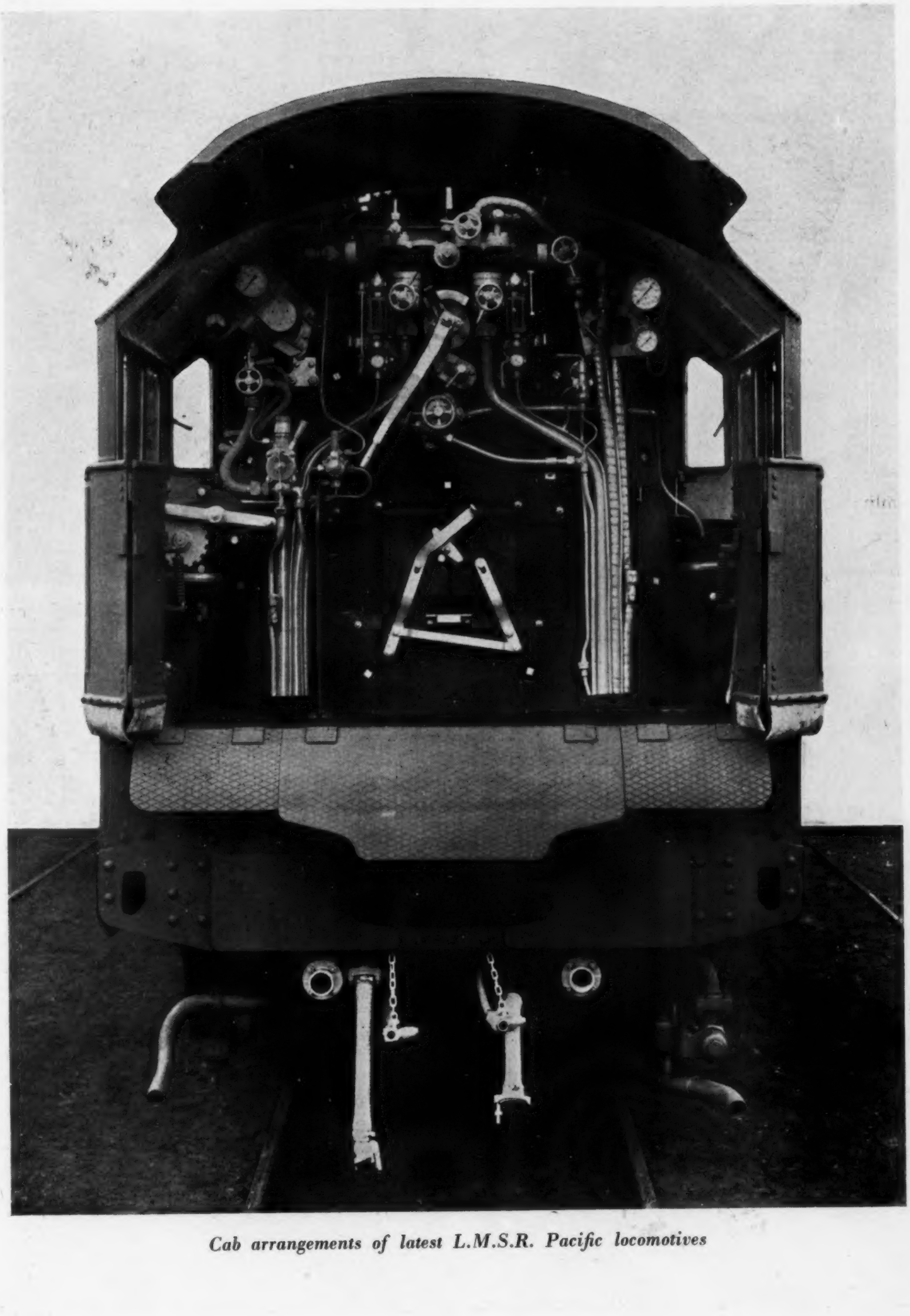
The principal dimensions of the class are as follow:—

Cylinders (4)	16½ in. dia. × 28 in. stroke
Boiler pressure	250 lb. per sq. in.
Driving wheels, dia.	6 ft. 9 in.
Total evaporative heating surface	2,807·5 sq. ft.
Superheater	856·0 sq. ft.
Combined heating surfaces	3,663·5 sq. ft.
Grate area	50·0 sq. ft.
Tractive effort at 85 per cent. b.p.	40,000 lb.

The first of the streamlined series, No. 6225, *Duchess of Gloucester*, is illustrated herewith. This engine, which weighs in working order about 108 tons, exclusive of the 56-ton tender, was used for hauling the special train by which the London members of the Institution of Locomotive engineers travelled to Glasgow on Wednesday last, June 8, for the annual summer meeting of the institution. Further reference to this meeting is made on page 1125 of the present issue.

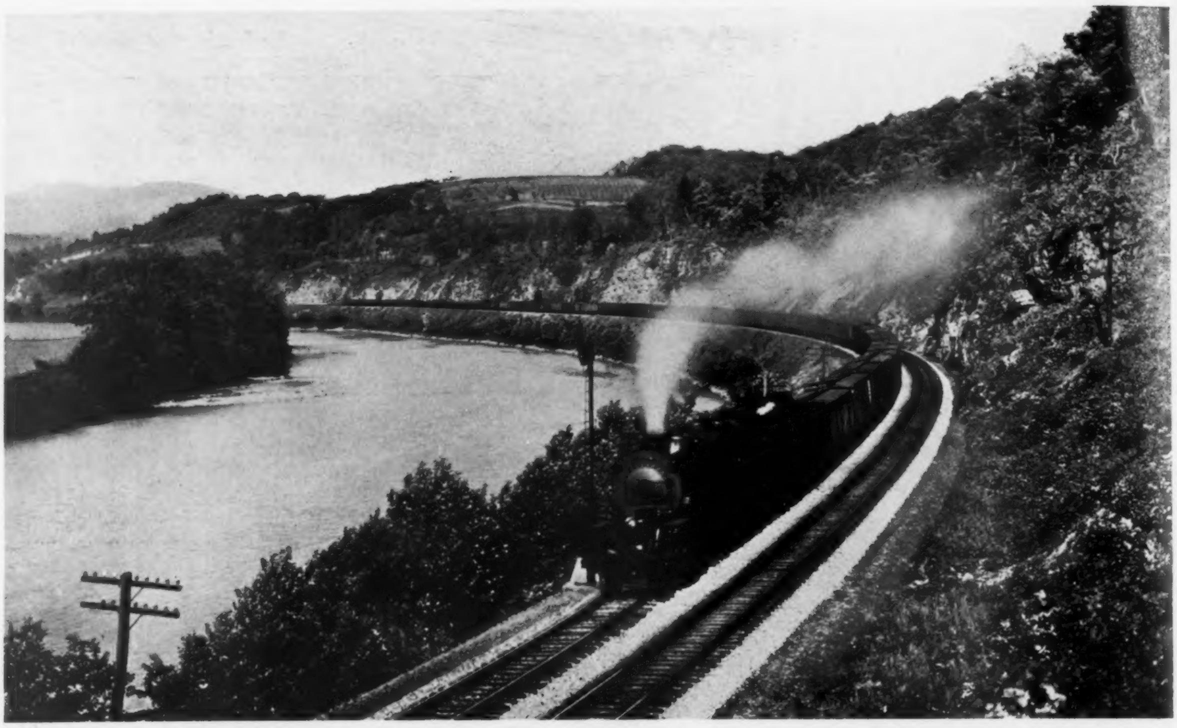


One of the new L.M.S.R. streamlined Pacifics, in red livery with gold bands. This engine hauled the special train from London to Glasgow for the Institution of Locomotive Engineers summer meeting on June 8



Cab arrangements of latest L.M.S.R. Pacific locomotives

Modern American Railway Scenes



Heavy freight train made up of cars from 20–25 railways and largely equipped with Cardwell draft gear, Norfolk & Western Railway

Another heavy freight train on the Missouri Pacific Railroad hauled by a 2-8-4 locomotive built by the Lima Locomotive Works

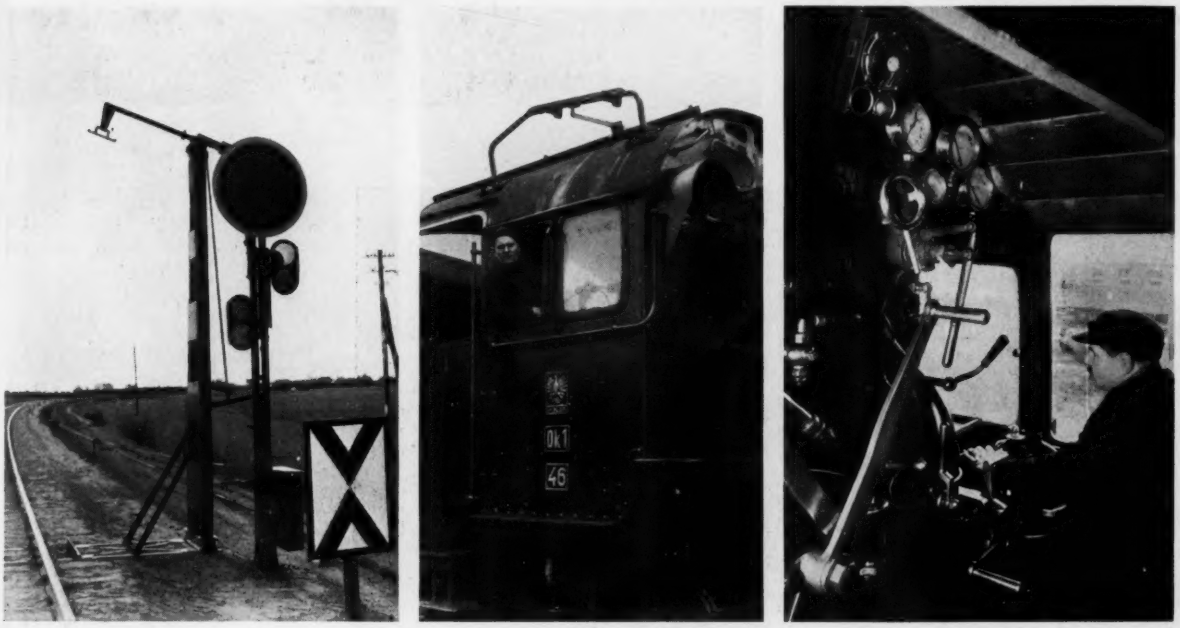
KOFLER A.T.C. IN POLAND

Installation of the latest form of this apparatus on a 46-mile section of the Polish State Railways

A 46-MILE section of the Polish State Railways, between Tluscz and Ostrolenka, has recently been equipped with the latest form of Kofler automatic train control apparatus, the original form of which was described in THE RAILWAY GAZETTE for August 26, 1932. The inventor has since improved the mechanism and added some electric controlling devices. The main portion of the apparatus is mechanical and consists essentially of a trip arm mounted on a support braced to the track adjacent to the signal (shown in the first of the accompanying illustrations) which, when the signal is "on," comes into contact with a trip stirrup on the locomotive cab (shown in the second illustration) and, pressing against it, actuates the locomotive brake-setting equipment or produces any other effect desired. Both distant and stop signals can be covered by the apparatus.

As soon as the track trip arm has acted on the locomotive mechanism, it is automatically disengaged from its actuating spindle and moves up clear of the structure gauge, so as to be out of the way of anything on the train that might be liable to foul it, and is restored to engagement at the next signal operation.

The additional electric apparatus (seen in the third picture) consists of a set of relays, a contact operated by the cab roof gear, red and green signal lights, hooter, resetting key, electrically controlled brake valve, and contact on driver's air brake valve. Normally the green signal light shows and the A.T.C. brake valve is held closed; but if the trip arm on the signal actuates the cab gear, the green light is extinguished, the red switched on and the hooter begins to sound. If the driver observes the warning and manipulates his brake valve handle, a contact on the latter is made causing all parts to return to normal. If he does not do so, a slow-acting relay causes a partial opening of the A.T.C. brake valve in 6 sec., resulting in a slight brake application and, if the driver continues to take no action, a full application shortly after. Operation of his brake valve will restore the apparatus and allow the driver to release the brakes.



Left: Apparatus at distant signal. Centre: Apparatus outside locomotive cab. Right: Locomotive cab showing booster, red and green lights, and brake control

The resetting key is to meet exceptional cases. We understand that this apparatus is also in use on the Resnik—Rypnia section of the Jugoslav State Railways.

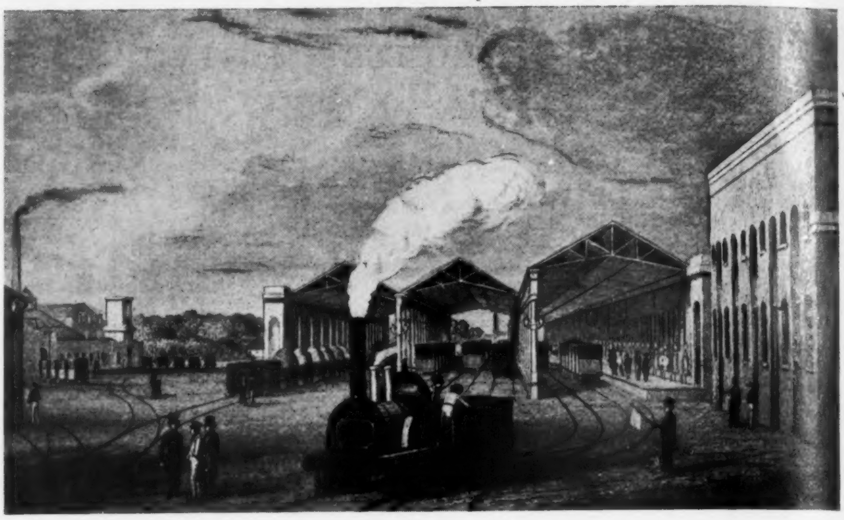
Storage of Grain

Railway companies, in common with traders, have experienced considerable losses through the destruction by insects of grain and grain products stored in their warehouses and there is no doubt that the total cost to the country runs into hundreds of thousands of pounds annually. With the co-operation and financial assistance of the railway companies and other interested bodies such as the National Farmers' Union, the National Association of Corn & Agricultural Merchants, the Research Association of British Flour Millers, and the Port of London Authority, a scientific survey of the problem is to be begun at once as a preliminary to the formulation of remedial measures.

The survey is to be carried out under the direction of the Department of Scientific and Industrial Research, by the Stored Products Laboratory of the Imperial College of Science and Technology.

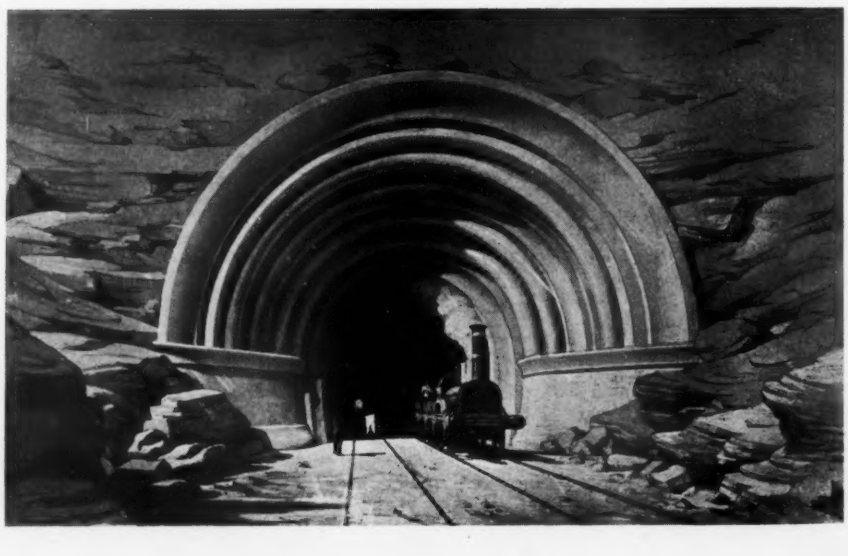
Some Early Views on the North Midland Railway

This line, which extended from Derby to Leeds, was opened from Derby to Masborough on May 11, 1840, and extended thence to Leeds on June 30, 1840. It was one of the constituents of the Midland Railway Company



Above: A print of 1840 showing "Derby Railway Station (interior)" on the North Midland Railway

Left: The North Midland Railway "Bridge over the River Amber and Turnpike Road near Amber Gate" in Derbyshire



Right: An experimental train being run through Milford tunnel, North Midland Railway, in May, 1840. The old print reproduced bears the title "Milford Tunnel, North Front"

RAILWAY NEWS SECTION

PERSONAL

Mr. E. J. Clarke, Chief Accountant, Leopoldina Railway, Brazil, arrived in England on leave on May 16.

Mr. J. T. Edmunds, who, as recorded in our issue of June 3, has been appointed Docks Manager, Port Talbot, Great Western Railway, entered railway service in the General Manager's Office of the Alexandra (Newport) Docks & Railway Company in July, 1905. Two years later he was transferred to the General Cargo Department, serving there in various capacities. In 1922, shortly after amalgamation with the Great Western Railway, Mr. Edmunds became Chief Clerk to the Newport Dock Manager. He was promoted in October, 1928, to the position of Assistant Dock Manager at Newport. Since January, 1933, Mr. Edmunds has occupied the position of Assistant Dock Manager at Swansea Docks. During that period he has been a member of the Executive, Negotiating, and other committees of the Swansea Port Employers' Association.

Mr. L. E. Ford, A.M.Inst.T., who, as announced in our issue of June 3, has been appointed Docks Manager, Cardiff and Penarth Docks, Great Western Railway, joined the Divisional Superintendent's Office at Cardiff on that railway in 1912. From 1914 to 1919 he saw war service, having first enlisted in the Welsh Regiment and subsequently accepted a commission in the 2nd Battalion, Monmouthshire Regiment, in 1915. Mr. Ford held various posts from 1919 to 1921 in the Traffic Department, London Division, and in the offices of the Superintendent of the Line, and the District Goods Manager, Birmingham; and at stations in that district. He was also included in the first quota of "special trainees" introduced in the latter year. In 1923 he was appointed Personal Clerk to Sir Felix Pole (General Manager), and transferred to the Docks Department that December, being attached to the Chief Docks Manager's Office in charge of the New Works Section. Mr. Ford was promoted to be Outdoor Cargo Assistant to the Docks Manager, Cardiff, in 1926, and Assistant in Charge, Penarth Docks, in 1928. Mr. Ford went to Swansea as Assistant Docks Manager in 1929 and was promoted to be Docks Manager, Port Talbot, in 1933. In his new appointment, Mr. Ford succeeds the late Mr. B. Carpenter, whose death we recorded in our issue of May 20.

Salvador J. Romero has been elected by the Mexican Railwaymen's Syndicates to the post of Manager of the Mexican National Railways, and the appointment was confirmed at a public meeting held on April 29. The Council of Administration appointed under the new organisation is made up of the following, also elected by the syndicates: Rafael S. Martinez, Santos Fierro, Francisco Aguilar, Jesus Zertuche, E. Teran Gomez, David del Arco, and Salvador J. Romero, the last-named being, as stated above, also the Manager. His appointment is the subject of an editorial article on page 1096, and news item, page 1128.

Mr. C. J. Challenger retires on June 30 from the post of District Goods Manager, Exeter, Great Western Railway, after over 46 years' service with the company. He began his railway career at Bristol Goods in 1891, and was transferred to the Bristol District Goods Manager's Office four years later. In 1904 he was transferred to the Chief Goods Manager's Office, where he spent 17 years in various sections prior to his appointment in October, 1921, as Assistant District Goods Manager, Bristol. In 1928 Mr. Challenger was appointed District Goods Manager at Exeter, from which position he now retires.

Mr. J. A. Williams, who succeeds Mr. Challenger as District Goods Manager, Exeter, G.W.R., entered the service of the Great Western Railway in April, 1900, in the Rates Department of the Chief Goods Manager's Office. Four years later he was transferred to the Traffic Department and served at various stations in the Bristol Division. In 1907 he was transferred to the Assistant Superintendent's Office at Penzance, and after the closing of that establishment was attached to the staff of the Divisional Superintendent at Plymouth as District Relief Clerk. From 1909 to 1912 he served in a similar capacity at the office of the Swansea Divisional Superintendent. In 1913 Mr. Williams returned to the Goods Department, taking up an appointment in the

Mr. J. T. Edmunds

Appointed Docks Manager, Port Talbot, Great Western Railway

Mr. L. E. Ford

Appointed Docks Manager, Cardiff and Penarth Docks, Great Western Railway

Mr. C. J. Challenger

District Goods Manager, Exeter, Great Western Railway, 1928-38

Cardiff District Goods Manager's Office, and remained in the Cardiff district until 1927 when he was transferred to Birmingham as Chief Clerk to the District Goods Manager. In 1932 he was appointed Chief Clerk to the Chief Goods Manager, which post he relinquishes to take up his new appointment.

Mr. A. Allen, Divisional Superintendent, Federated Malay States Railways, has been appointed General Manager and Traffic Manager, Sierra Leone Government Railways.

Mr. Glen H. Caley has been appointed General Manager, Delaware & Hudson Railroad, in charge of Operations, Maintenance, Construction, Purchases, and Stores.

From *The London Gazette* of May 24: Supplementary Reserve of Officers, Royal Engineers, Transportation: Arthur William Hubbard (late Cadet C.S.M., Elizabeth Coll. Contgt., O.T.C.) to be Second Lieutenant (May 19).

Mr. J. G. K. Agnew, whose appointment as System Manager, Kimberley, South African Railways, was recorded in our issue of May 20, has now been transferred to Bloemfontein in a similar capacity, and has been succeeded at Kimberley by Mr. C. H. Hamilton.

Mr. A. I. Raisman, Engineer in charge of Design, New York Board of Transportation, has retired after 38 years of urban railway service. He has an international reputation in the field of underground railway construction.

The board of Stephenson Clarke and Associated Companies Limited announces that the Rt. Hon. Lord Hyndley has been elected Chairman of the company in succession to Sir Stephenson H. Kent, K.C.B., who retired recently.

L.M.S.R. Appointments

The following appointments have been approved by the directors:—

Mr. J. R. Pike, Assistant (Research), Chief Commercial Manager's Office, Euston, to be Assistant (Rates & Charges), Chief Commercial Manager's Office, Euston.

Mr. G. F. C. Frost, Deputy Assistant for Research, Chief Commercial Manager's Office, Euston, to be Assistant (Research), Chief Commercial Manager's Office, Euston.

Mr. F. Gilman, Chief Cartage Clerk, District Goods Manager's Office, Bolton, to be Commercial Assistant to District Goods Manager, Bolton.

Mr. J. Bell, District Signal & Telegragh Assistant, Perth, to be District Signal & Telegraph Assistant, Glasgow (St. Enoch).

Mr. R. McLeod, Inspector, Signal & Telegraph Department, Perth, to be District Signal & Telegraph Assistant, Perth.

Mr. R. Gillies, Clerk-in-Charge (Goods Station Working & Cartage Section), Operating Manager's Office, Glasgow, to be Goods Agent, Glasgow (Buchanan Street).

Mr. A. Shirt, Goods Agent, Stalybridge, to be Goods Agent, Denton.

Mr. W. Hubbard, Goods Agent, Moses Gate, to be Goods Agent, Darwen.

Mr. W. Hamilton, Running Shed Foreman, Hamilton, to be Assistant District Locomotive Superintendent, Perth (South).

Mr. G. J. Aston, Temporary Assistant District Controller, Leicester, to be Assistant District Controller, Toton.

Mr. M. Frieze, Assistant to Chief Permanent Way Inspector, Glasgow (St. Enoch), to be Chief Permanent Way Inspector, Glasgow (St. Enoch).

Front row, left to right: Messrs. J. W. Dunger (Passenger Manager's Office, Southern Area); F. C. C. Stanley (District Passenger Manager, Newcastle-on-Tyne); G. Marshall (Goods Manager, Southern Area); Sir Nigel Gresley (Chief Mechanical Engineer); Messrs. T. S. Falck, Jr. (Director, Bergenske Dampskibsselskab); Ashton Davies (Chief Commercial Manager, L.M.S.R.); E. M. Rutter (Passenger Manager, North Eastern Area)

Back row, commencing fourth from left: Messrs. H. A. Butcher (Stationmaster, Newcastle-on-Tyne); W. A. Fiddian (District Superintendent, Newcastle-on-Tyne); C. K. Bird (Assistant Goods Manager, Southern Area); J. A. Kay (Editor, The Railway Gazette); C. Daniels (Passenger Manager's Office, Southern Area); J. E. Kitching (Portmaster, Grimsby Docks); G. H. Loftus Allen (Advertising and Publicity Officer, L.M.S.R.); G. Leedam (Secretary and Manager, Cheshire Lines Committee); F. Goodricke (Assistant Advertising Manager)

Group of L.N.E.R. officers and others on board the inaugural trip of the new B. & N. Line ms. "Vega" for the Newcastle-Bergen service

Photo by] [*A. V. Swaebe*

BIRTHDAY HONOURS

Viscount

Rt. Hon. William Douglas, Baron Weir.

Barons

Sir Josiah Charles Stamp, G.C.B., G.B.E., Chairman and President of the Executive, L.M.S.R.

Mr. Vivian Hugh Smith, Director, Associated Electrical Industries Limited.

G.B.E.

Right Hon. the Earl of Onslow, Lord Chairman of Committees in the House of Lords since 1931.

Knight Bachelor

Col. E. G. Hippisley-Cox, C.B.E., T.D., Secretary of the Parliamentary Agents' Society.

K.C.B.

Mr. Leonard Browett, C.B., C.B.E., Permanent Secretary, Ministry of Transport.

Sir William B. Brown, K.C.M.G., C.B., C.B.E., Permanent Secretary, Board of Trade.

Sir Cyril W. Hurcomb, K.B.E., Chairman of the Electricity Commission (President, Institute of Transport).

K.C.M.G.

Mr. Dougal Orme Malcolm, Director, Beira Railway Company.

C.S.I.

Mr. Satyendra Nath Roy, C.I.E., Indian Civil Service, Secretary to the Government of India in the Department of Communications.

C.I.E.

Mr. Tirunelveli S. Sankara Aiyar, Indian Audit and Accounts Service, Director of Finance to the Government of India in the Railway Department (Railway Board).

C.B.E. (Civil Division)

Mr. Kenneth C. Strahan, Chief Mechanical Engineer, Kenya & Uganda Railways & Harbours.

O.B.E. (Civil Division)

Mr. Arthur Feirn, Assistant Director of Transport Accounts, Ministry of Transport.

M.B.E. (Civil Division)

Mr. Harry Clifford Greenfield, Stationmaster, Waterloo station, S.R.

Mr. Charles Walker Rozario, Asiatic Traffic Inspector, Federated Malay States Railways.

Mr. Hugh Vanhegan, Assistant Superintendent, Kenya & Uganda Railways & Harbours.

Forthcoming Meetings

June 14 (*Tues.*).—**Antofagasta (Chili) & Bolivia Railway Co. Ltd.** (Ordinary General), Winchester House, Old Broad Street, E.C, at noon.

June 17 (*Fri.*).—**British Electric Traction Co. Ltd.** (General), Winchester House, Old Broad Street, E.C.3, at 11.30 a.m.

Forthcoming Events

June 8-12.—Institution of Locomotive Engineers, at Glasgow. Summer Meeting.

June 15 (*Wed.*).—Institution of Civil Engineers, Great George Street, London, S.W.1, 7.45 p.m. Conversazione.

June 17-21.—Stephenson Locomotive Society. Summer Tour to Ireland and Western Scotland.

Institution of Locomotive Engineers

Summer Meeting in Glasgow June 8-12

The London members attending the summer meeting of the Institution of Locomotive Engineers in Glasgow, accompanied by Dr. R. P. Wagner, and several other German visitors, left Euston on Wednesday last, June 8, at 9.50 a.m. in a special train provided by the L.M.S.R. This was hauled by one of the newest of Mr. Stanier's 4-6-2 streamlined express engines, No. 6225, *Duchess of Gloucester*, illustrated on page 1118 of this issue, and scheduled to reach Glasgow (Central) at 4.45 p.m., with a stop at Carlisle. The company's dynamometer car was attached to the train, so that observations as to the performance of the locomotive could be made *en route*. Many members of the party took advantage of the facilities thus afforded and an inspection was made of the engine prior to the departure of the train from Euston. The train consisted of seven vehicles, including the dynamometer car, representing a train-load of 232 tons, exclusive of the engine and tender.

9.50 A.M. SPECIAL EUSTON–GLASGOW RUN, JUNE 8. ENGINE NO. 6225, 4-6-2 LOAD 232 TONS (INCLUDING DYNAMOMETER CAR)

Place	Booked Time H. M.	Actual Time H. M. S.	Speed M.P.H. at Various Points	Cut Off %	Regulator Opening
Euston ..	9 50	9 50 0		30 20	
Willesden ..	59	59 0	68 70		Full
Watford ..	10 11	10 12 30	80 68		
Tring ..	25	24 30	66 80		
Bletchley ..	37	36 20	76		
Roade ..	48	46 40	63·5		
Bl.sworth ..	51	49 20	71		
Rugby ..	11 12	11 10 30	72		
Nuneaton	26	24 40	79	15	
Lichfield ..	43	40 40	38		
Rugeley ..	50	48 0			
Stafford ..	59	56 30			
Norton Bridge	12 4	12 1 45			
Whitmore ..	13	9 10	55		
Crewe ..	23	20 25			
Coppenhall Jc.	28	25 26	66		
Winsford Jc.	34	30 30	75		
Weaver Jc.	41	37 30	71·0 72·0		
Warrington	49	48 20			
Winwick Jc.	12 53	12 53 55		19	
Wigan ..	1 2	1 2 0			
Standish Jc.	6	7 40	86 88	15	Full
Euxton Jc.	13	13 25			
Preston ..	19	20 45		19	
Oxheys ..	22	23 50	80		Full
Garstang ..	30	30 55	83 72		
Lancaster ..	40	40 20	79	15	
Carnforth ..	45	45 25	82 70		
Oxenholme	59	56 40	58 41·5		
Tebay ..	2 15	2 12 0	60 55* 43	19	Full
Shap Summit	24	19 35	60		
Penrith ..	37	32 25		Coast	Coast
Plumpton ..	41	37 10			
Carlisle A	2 54	2 53 50			
D	2 56	2 57 10			1st
Gretna ..	3 6	3 6 20	68 76	15	
Lockerbie ..	22	20 40	80 80		Full
Beattock ..	33	31 20	76		
Beattock Summit	48	41 45	50†	20–25	Coast
Symington	4 3	57 10			
Carstairs	9	4 3 30			
Motherwell	26	21 0		15	
Newton ..	34				
Glasgow ..	4 45				

* Average speed Tebay—Shap Summit, 51·5 m.p.h.

† Average speed on Beattock, 57·6

With a train-load of such moderate proportions, very little demand would, of course, be made on the capabilities of an engine of the size and power of that used, exerting a tractive force of 40,000 lb. From the locomotive point of view, the run resolved itself into what may best be termed an effortless performance, and had circumstances required it, no difficulty would have been met with in completing the run in considerably less time than that occupied.

By courtesy of Mr. W. A. Stanier, we are able to reproduce a log of the journey, showing the booked and actual timings, speed in miles per hour, range of cut-off and corresponding regulator openings at various points and over consecutive distances *en route*.

It will be noted from these particulars that the average speed on the 10-mile ascent of Beattock was 57·6 m.p.h.; the summit was passed at a speed of 50 m.p.h. On Shap the average speed was 51·5 m.p.h. The coal consumption for the run averaged 28·2 lb. per mile. For the whole run the train averaged 58·7 m.p.h., and attained a maximum speed of approximately 90 m.p.h.

The smooth running of the train and the arrangements made for their reception were highly praised by the German visitors.

MACHINE ACCOUNTING EXHIBITION.—An exhibition of mechanical accounting equipment, occupying nearly 7,000 sq. ft. in Chesham House, 136 Regent Street, London, W.1 (nearly opposite New Gallery Cinema), will be held from June 13 to 17. Nearly a hundred different machines and modern systems for every kind of accounting and statistical work will be demonstrated at this show. Visitors will be able to inspect the latest mechanical developments for invoicing, adding, bookkeeping, calculating, and statistical work, and so on. The organisation of the exhibition, which will be open from 2 p.m. to 7 p.m. daily, is being carried out by Burroughs Adding Machine Limited.

The Collision at Charing Cross, District Line

Verdict of negligence at inquest

On June 2 the Coroner for Westminster, Mr. Ingleby Oddie, concluded the inquest on the six passengers killed in the collision on the District Line of the L.P.T.B. on May 17; the first half of the proceedings were reported in THE RAILWAY GAZETTE for June 3, page 1085.

Chief Lineman A. G. Beer said he instructed Installer C. W. Eeles (who did the wiring of the signal circuit before the accident) to go on squaring up and tidying the work, but said nothing definite about the cables in the circuit-breaker box; he was not aware when he went into the signal cabin at 5.0 a.m. on May 17 that Eeles had detached any cables or re-fastened terminals or he would have tested them.

Chief Signal Inspector F. Baker said a complete alteration had been made in that circuit-breaker box on the night of May 7-8, but a wrong connection to the right hand terminal screw could not have lasted from then to May 17 without being discovered. The mistake Eeles must have made would be easy to commit if he was not thinking at the moment. A thorough test made on the night of May 18 showed that Eeles made a wrong connection on May 17, when Beer should himself have made a test; tests were imperative after wiring alterations.

Motorman J. W. Longley said he was driving a train which left Charing Cross at 9.34 a.m. and saw another in front of him in the same section. At Temple he told the station foreman to inform Charing Cross that the starting signal was failing in the "off" position. He later told an inspector.

Station Foreman A. W. Foskew, Temple, said Charing Cross telephoned for Longley to be asked why he had stopped short after leaving there, and that Longley, on arriving, gave him the above message. When the train had left he called to Porter Hopkins to telephone it to Charing Cross. He was sure he said "'off' position" to him; it would be a great mistake on his part to have said "'on' position." Foskew further said he had received messages to the same effect from three other drivers; one said he nearly hit another train. He soon after saw a train standing in the tunnel, borrowed a lamp and went to see what the trouble was. He then learned there had been a serious accident. As it was a Charing Cross signal which was failing he thought it to be the duty of that station to telephone to the Controller and others concerned. It was a busy time on the platform with long trains to attend to; to call to the porter and tell him to speak to Charing Cross was the quickest thing to do. He had been 19 years with the District Railway and had never known a signal fail in the "off" position before.

Porter C. Hopkins said he received the message from Charing Cross about Longley's train and called across to Foskew, who, when the train had gone, told him to inform Charing Cross that the signal was failing in the "on" position. Who received his message he did not know, but they could not understand it. Other trains went through whistling and a similar message was sent. He did not know the difference between a signal being "on" and "off." Charing Cross made inquiries as they could not understand what he meant by the "on" position.

Mr. Ingleby Oddie, summing up, said the jury might feel the evidence showed that the accident ought not to have happened, and that these valuable lives would not have been lost had the servants of the railway performed their duty with exactness in a satisfactory way.

With regard to Holbourn, driver of the Barking train, who could blame him? Was he not a brave man to get down on the line with his red light, doing all he could to try and save life, realising that the train which ran into him might have been derailed, and that a west-bound train coming along would cause a worse accident?

There was no doubt of the disastrous effect of the wrong connection. The train would have been safe but for the maladjustment of the cable wire by Eeles. It was not his duty to test the signals. He had a supervisor, and it was his duty. Beer was a supervisor to see what tests were necessary. They might feel that he did not perform his duty by applying a test so simple when it would have saved these lives if it had been applied.

Foskew thought he was doing what was best. Were they satisfied with his explanation? If so, they would not find him to blame. That would be an error of judgment, committed with the best intentions.

The Verdict

After a retirement of 25 minutes the jury recorded the following verdict: "We find that the accident was caused by the serious negligence of Beer and the contributory negligence of Foskew, but in neither case does it amount to criminal negligence. We find that the mistake of Eeles amounted only to an error of judgment. We wish highly to commend the courage and presence of mind of Holbourn (driver of the Barking train) and express our deepest sympathy with the relatives."

STAFF AND LABOUR MATTERS

Young Persons (Employment) Bill

This Bill, which is to regulate the hours of employment of certain young persons under the age of 18 years, was introduced in the House of Lords on May 26 and was read a second time on June 2. Among the employments covered by the Bill are:—

(*a*) Employment in the collection or delivery of goods, or in carrying, loading or unloading of goods incidental to the collection or delivery thereof.

(*b*) Employment at any premises in carrying messages or running errands, being employment wholly or mainly outside the premises.

(*c*) Employment at a residential hotel or club in carrying messages or running errands, or in connection with the reception of guests or members thereat.

(*d*) Employment elsewhere than in a private dwelling-house, in the operation of a hoist or lift connected with mechanical power.

The Bill provides that hours are to be limited to 48 a week and after two years the hours for boys under 16 years are to be reduced to 44 a week. Overtime is permitted in the case of young persons who have attained 16 years of age but is limited to six hours in a week or fifty hours in any year, and where in any year overtime has taken place in twelve weeks no further overtime is allowed during the remainder of that year. The youths covered by the provisions of the Bill are not to be employed continuously for more than five hours without an interval of at least half an hour for meal and rest; and if employed between 11.30 a.m. and 2.30 p.m. they are to be allowed between those hours an interval of not less than three-quarters of an hour for dinner. On at least one week-day in each week they are not to be employed after 1 o'clock. Employment between the hours of 10.0 p.m. and 6.0 a.m. is prohibited, and if employed on a Sunday, a whole holiday on a week-day is to be given.

During the discussion on the second reading of the Bill the Earl of Radnor said that vanboys employed by the railway companies could not come within the same category as boys included in the Bill because vanboys generally were looked upon as being in a "blind alley" occupation but that was not so in the case of the railway companies. The Bill so far as the railway companies were concerned attacked the principle of voluntary collective agreements. He understood that the particular trade union which was concerned with the railway companies considered that as drafted and with the inclusion of the railway vanboys, the Bill would probably be unworkable.

The Earl of Munster said that the Government would be prepared to consider any representations that might be made by the railway companies, although he could give no promise of accepting an amendment.

Railway Students' Association Annual Convention

Meetings and vists in South Wales last weekend

The annual convention of the Railway Students' Association of the London School of Economics, London University, was held this year in South Wales from Saturday, June 4, to Tuesday, June 7, under the Presidency of Viscount Horne of Slamannan, Chairman of the Great Western Railway. The headquarters of the convention were in the Central Hotel, Cardiff, for the first two days and the Hotel Metropole, Swansea, for the remainder of the stay in South Wales.

Lord Horne, in formally opening the proceedings on Saturday last, congratulated the delegates on their enthusiasm for the study of transport in denying themselves their usual Whitsun vacations in order to attend the convention. Railways as a means of transport, he said, had always been linked closely with the industries of South Wales, and they had gone hand in hand through the changing phases of prosperity and decline.

Mr. C. E. Boxall, District Goods Manager, G.W.R., Cardiff, then gave an address of welcome on behalf of the transport undertakings of Cardiff and district. Mr. Boxall briefly outlined the nature and development of the docks and transport undertakings of the district, from the time of the old Glamorgan canal. Other points on which he dwelt were the movement of heavy industries towards the seaboard and how the stricken valleys were compensating themselves for this and losses due to trade recession.

At the conclusion of Mr. Boxall's address, Lord Horne called upon Mr. Ewart R. Evans, General Manager, Coal Distributors (South Wales) Limited, to deliver a paper entitled "The Effect of Transport upon Industries." Mr. Evans in a spirited address reviewed the various methods of transport employed in the Cardiff area and how the services they offered were utilised by the trading community. A statement which caused a good deal of discussion was, when referring to the breakage of coal in transport, the speaker maintained that though the railway companies had done a great deal to improve matters a complete solution had not yet been found. A lively discussion followed the reading of the paper and Lord Horne wound up the proceedings with a vote of thanks to Mr. Evans.

There followed a civic welcome to the association, members of which were received by the Lord Mayor of Cardiff, Alderman O. Cuthbert Purnell, who was afterwards entertained to lunch. During the afternoon a visit was paid to the splendid National Museum of Wales in Cardiff's Civic Centre. The handsome interior appointments of the adjacent City Hall were also inspected and tea was taken there at the invitation of the Lord Mayor. Later, in the evening, the G.W.R. Control Office at Queen Street was visited and, under the able guidance of Mr. L. E. Ford, City Docks Manager, G.W.R., and his assistant Mr. L. J. Lean, a most interesting tour of the company's extensive Cardiff dock system was made. The day was concluded by a motor-coach tour to Caerphilly and to Treforest, where a view of the well-known trading estate was obtained.

After this strenuous opening, Sunday was in comparison truly a "day of rest." During the morning the members travelled to Swansea, after paying a short visit to the new 339-lever electrically-operated signal box at Cardiff West. After lunch opportunity was taken of exploring the Gower peninsula, one of the most lovely and unspoiled stretches of coast in the country. The fascinating Swansea & Mumbles Railway also came in for a great deal of enthusiastic attention. Monday was devoted to a rail expedition to Tenby, a charming seaside resort, although the weather did nothing to improve it on this occasion.

On Tuesday morning, Mr. L. W. Orchard, Chairman of the Committee of the association presiding (in place of Lord Horne, who was unable to be present), an Address of Welcome was given by Mr. H. W. Morgan, Docks Manager, Swansea, G.W.R., following which a paper entitled "The Effect of Industry on Transport" was read by Mr. W. Davis, District Goods Manager, Swansea, G.W.R. This was, of course, a paper delivered from a railwayman's experience, whereas Mr. Evans' paper on Saturday was presented from a trader's outlook. Mr. Davis' paper, which explained how his company met the often exacting transport needs of the tinplate, anthracite, dairy and other light and heavy industries of the Swansea district, was voted one of the best ever delivered to the association. The speaker's words were assisted home by the distribution of maps, plans, samples of minerals and other interesting items. During the afternoon an enjoyable and unusual tour of Swansea Docks was made on board the G.W.R. steam-tug *Trusty*. This visit was under the guidance of Mr. H. W. Morgan who with an invitation to the members to an excellent tea brought in the last item and thus the end to a first-rate convention held in an area of the most diverse interests.

Among those also present at the convention were the following:—

Messrs. L. W. Orchard, H. Bailey, S. E. Bellamy, C. A. Nisbet, H. F. Orchard, A. F. Wallis, H. C. Hill, S. B. Taylor, G. E. Williams, E. R. Woollatt.

RAILWAY AND OTHER REPORTS

Bengal & North Western Railway Co. Ltd.—After placing £35,000 to sinking fund, the directors have declared an interim dividend for the half-year ended March 31, 1938, of 4 per cent., together with a bonus of 4 per cent., or 8 per cent. in all, less tax at 3s., on the ordinary stock, the same as a year ago. The dividend is payable July 25.

Rohilkund & Kumaon Railway Co. Ltd.—The board has declared an interim dividend for the half-year ended March 31, 1938, of 4 per cent., together with a bonus of 4 per cent., making 8 per cent. in all on the ordinary stock, less tax at 2s. 11d., payable on July 25. For the corresponding period of 1936–37 the interim dividend was 4 per cent. and the bonus 3 per cent.

Rhodesia Railways Trust Limited.—Income for the year to March 31 last totalled £82,547, a decrease of £64,150 on the previous year's figure, which included a dividend of £67,440 from Rhodesia Railways Limited and interest for six months to September 30, 1936, on the loan to the Mashonaland Railway Company. Net profits declined from £115,856 to £59,018. The dividend is, however, maintained at 5 per cent. tax free, and the carry forward is reduced from £300,857 to £259,587. During the year the debt owing to the Mashonaland Railway Company at March 31, 1937, was realised at a loss of £7,595. This has been written off against reserve for interest accrued but not received. The balance of this reserve, amounting to £35,910, has been transferred to reserve for depreciation of investments.

Chloride Electrical Storage Co. Ltd.—For the year to March 31, 1938, net profits were £352,679, against £364,817 for the previous year, after increasing tax provision from £54,000 to £65,000 and writing off £4,405 in respect of loss by a subsidiary. The final dividend on the A and B ordinary stock is again 5 per cent., but the cash bonus is doubled at 10 per cent., which raises the year's distribution from 15 per cent. to 20 per cent. The sum of £12,000 is again allocated to employees' funds and £15,000 (against £25,000) is applied towards the establishment of a pensions fund for employees of subsidiaries. The amount to be carried forward is £89,149, against £84,580 brought in.

Ruston & Hornsby Limited.—The balance on trading account for the year to March 31 last, after charging depreciation, making provision for stock and other contingencies, and including dividends receivable from subsidiary and associated companies, and after charging debenture interest, was £204,876, against £140,906, and £50,124 was brought forward. The directors recommend a dividend of 7½ per cent. on the ordinary stock, less tax, against 6¼ per cent. Reserve for income tax and N.D.C. receives £20,000, against nil, and general reserve £57,450, against £50,000, leaving £61,000 to be carried forward.

NOTES AND NEWS

L.M.S.R. (N.C.C.) Traffics.—Receipts of the Northern Counties Committee (L.M.S.R.) for the week ended May 27 amounted to £6,350, a decrease of £1,125. For the 21 weeks of the current year the aggregate earnings were £130,839, a decrease of £9,088.

Reopening a Scottish Railway.—With the introduction of the summer timetable on July 4, the L.M.S.R. branch from Brechin to Edzell (Angus), 6 miles in length, will be reopened for passenger traffic. Owing to the great decline in traffic, passenger services were withdrawn as from April 27, 1931, but the L.M.S.R. authorities now consider that changed circumstances warrant the passenger service being restored as an experimental measure.

Tongking China Railway Connection. — According to information supplied by Reuters, a group of French banks headed by the Banque Indo-Chinoise have agreed to finance the construction of a railway from French Indo-China to Nanning, in the Southern Chinese Province of Kwangsi, a distance of about 120 miles. The new railway would form an extension of the existing line running from Hanoi to the frontier near Lang Son, and, presumably, run thence *via* Lungchow and Taiping Fu to Nanning.

British Airways Transferred to Heston.—From May 30 the London terminus for the services of British Airways has been Heston airport, instead of Croydon, as heretofore. The inter-terminal (Croydon-Heston) air service of Air Dispatch was resumed on May 23, and now operates three times a day to cater for increased traffic consequent upon the British Airways change. Passengers by British Airways to and from the Continent will thus still be provided with connections with the internal routes of Railway Air Services based on Croydon.

Scottish Machine Tool Corporation Limited.—At the first ordinary general meeting of the Scottish Machine Tool Corporation Limited, Sir Harry Greer, the Chairman, said that the profit and loss account disclosed earnings for the year of £81,374, and a net profit, subject to taxation, of £69,526, which was almost 17½ per cent. of the issued capital. The dividend recommended was 8 per cent., less tax. The corporation consisted of five distinct units :—James Bennie & Sons Ltd., Craig & Donald Limited, James Allen Senr. & Son Ltd., G. & A. Harvey Limited, and Loudon Bros. Ltd., and the continuity of the constituent units had been consolidated on a permanent basis. Internal competition had been eliminated, and the interchange of experience and information by the management had resulted in a substantial reduction in expenses, particularly in the use of patterns. The company's products continued to lead in the special markets which it served, and there was substantial evidence of the satisfaction given to customers throughout the world.

Government Purchase of Landskrona-Trälleborg Railway, Sweden.—A Reuters message from Stockholm dated May 30 states that the Riksdag has accepted a Government proposal for the purchase and incorporation in the State Railways system of the privately owned Landskrona–Lund–Trälleborg Railway at a cost of Kr. 1,250,000. The length of the line is 74 km.

Agreed Charges.—Sixty-two more applications for the approval of agreed charges have been lodged with the Railway Rates Tribunal, as will be seen from the legal notice published on page 1130. A copy of each application (1s. post free) can be obtained from Mr. G. Cole Deacon, Secretary, Rates and Charges Committee, Fielden House, Great College Street, Westminster, S.W.1. Notices of objection must be filled on or before June 28, 1938.

Great Western of Brazil Railway Co. Ltd.—Following on the decision of the High Court of Justice in January last negotiations took place with some of the largest holders of the 4 per cent. debentures and the permanent 6 per cent. debenture stock of the Great Western of Brazil Railway Company with a view to arriving at an arrangement to settle the question of priorities between these issues. As a result a scheme of arrangement has been framed which will be submitted to separate meetings of holders of these issues convened for June 21 at River Plate House, E.C.

Management by Employees of Mexican National Railways.—The organ of the railway employees in Mexico, *Ferronales*, publishes a full account of the ceremony which took place before a large audience at the Fine Arts theatre in Mexico City on April 29, under the presidency of General Mújica, Secretary of State for Communications and Public Works, when the Council of Administration which is to take over the management of the National Railways, was formally appointed under the Decree of the Government. This ceremony, according to *Ferronales*, represents the fulfilment of a long-cherished plan of the President of the Republic, Sr. Cardenas, and marks an important stage in the emancipation of the workers. The membership of the council is shown in our Personal section on page 1123. Sr. Salvador J. Romero has been selected by the Syndicate of Railway Workers to be Manager of the railways under the new organisation. The new Manager is a well-known labour leader, and was President for many years of the Alianza de Ferrocarrileros, precursor of the Syndicate of Railwaymen. He entered the railway service as a telegraphist in 1911, passing through various departments to a head clerkship in the management office. The date fixed for the handing over of the administration of the National Railways to the new Manager and Council of Administration was May 1.

B.S.S. for Galvanised Corrugated Steel Sheets.—A new British Standard Specification (No. 798/1938) has been issued for galvanised corrugated steel sheets. It establishes a higher standard of quality than the ordinary commercial brand hitherto in general use, which should ensure good appearance and prolonged life. The specification lays down a standard of quality applicable to sheets of any size and for 3-in. and 5-in. corrugations and the British tile. Among its requirements is a guaranteed minimum coating of spelter of 1·75 oz. per sq. ft. of sheet (including both sides). The new sheets will be marketed under the trade name 175, and will be manufactured by all sheetmakers in the country. Copies of the new specification may be obtained from the British Standards Institution, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

Victorian Railways Posters.—"Australia for Winter Sports" is an unexpected slogan, the truth of which enthusiasts in Europe with ample time and money may care to investigate, remembering that the Australian winter coincides with our summer. Every encouragement to do so is offered by a fine snow-scene poster which we have received from the Victorian Government Railways, on which are enumerated various centres served by the administration where winter sports may be enjoyed. Another poster invites visitors to the Royal Park Zoo, Melbourne, with the reminder that a service of fast electric trains is provided to and from the park. The holiday district of Gippsland is represented on another poster by a series of photographic reproductions illustrating its scenery and facilities for sport and recreation. All these posters are linked with the name of a camera manufacturer, a three-word exhortation to visitors to go equipped with one of his products appearing at the foot of each.

L.M.S.R. Stations.—Alterations in regard to L.M.S.R. stations which will come into force on July 4 include : Foryd station, on the North Wales Coast between Rhyl and Abergele, which was closed for passenger traffic in 1931, will be reopened (except on Saturdays) between July 4 and September 2 inclusive under the name of Kinmel Bay halt, in order to cater for summer visitors to the camps, bungalows, and houses on the Kinmel Bay estate. The halt will deal only with passengers and orders for luggage in advance. Clifton and Lowther station, between Shap and Penrith, will be closed for passenger traffic owing to the continued decline in this business. Both Clifton and Lowther villages are on the direct Penrith-Kendal bus route, whilst alternative rail facilities will still be available from Clifton Moor station (L.N.E.R.), half-a-mile distant. Clifton and Lowther L.M.S.R. station will remain open as a "full load" depot for

goods and mineral traffic, and for livestock by arrangement, whilst motor delivery of parcels traffic and small goods consignments will be effected from Penrith. Clown station (Derbyshire), on the Mansfield and Chesterfield line, will be renamed Clown and Barlborough; the renaming of the former "Clowne" by the L.N.E.R. (from May 2) was recorded on page 855 of our April 29 issue. Bispham station, between Blackpool North and Thornton, will be renamed Layton (Lancs.).

Parliamentary Notes

L.M.S.R. Bill : Royal Assent

The Royal Assent was given on June 2 to the London Midland & Scottish Railway Act, 1938.

Brighton Corporation (Transport) Bill

This Bill was read the third time and passed in the House of Commons on June 2. On the same day it was given a first reading in the House of Lords, and was referred to the Examiners.

Questions in Parliament

Railways Agreement Act

Mr. David Adams (Durham, Consett—Lab.) on June 2 asked the Minister of Transport whether, in view of the fact that the Great Western Railway Company, in agreement with the Ministry, had decided to defer schemes of development involving the expenditure of between £2,250,000 and £3,000,000, whether his department had arranged to defer other schemes of capital expenditure till employment was less general; and would he state the nature and extent of the same.

Dr. Leslie Burgin (Minister of Transport): There has been no general postponement of the works to be carried out under the Railways (Agreement) Act, 1935. My decision to allow an extension till January 1, 1945, of the date for completing certain schemes of the G.W.R. was taken after careful consideration of the circumstances relating to the particular works in question.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 22nd Week			Totals to Date		
	1938	1937	Inc. or Dec.	1938	1937	Inc. or Dec.
L.M.S.R. (6,852½ mls.)	£	£	£	£	£	£
Passenger-train traffic...	676,000	513,000	+ 163,000	9,718,000	9,810,000	– 92,000
Merchandise, &c. ...	434,000	514,000	– 80,000	10,464,000	10,737,000	– 273,000
Coal and coke ...	235,000	247,000	– 12,000	5,933,000	6,011,000	– 78,000
Goods-train traffic ...	669,000	761,000	– 92,000	16,397,000	16,748,000	– 351,000
Total receipts	1,345,000	1,274,000	+ 71,000	26,115,000	26,558,000	– 443,000
L.N.E.R. (6,315 mls.)						
Passenger-train traffic...	400,000	339,000	+ 61,000	6,297,000	6,430,000	– 133,000
Merchandise, &c. ...	320,000	360,000	– 40,000	7,301,000	7,430,000	– 129,000
Coal and coke ...	218,000	257,000	– 39,000	5,584,000	5,630,000	– 46,000
Goods-train traffic ...	538,000	617,000	– 79,000	12,885,000	13,060,000	– 175,000
Total receipts	938,000	956,000	– 18,000	19,182,000	19,490,000	– 308,000
G.W.R. (3,737 mls.)						
Passenger-train traffic...	273,000	219,000	+ 54,000	4,062,000	4,111,000	– 49,000
Merchandise, &c. ...	193,000	215,000	– 22,000	4,251,000	4,303,000	– 52,000
Coal and coke ...	101,000	115,000	– 14,000	2,522,000	2,512,000	+ 10,000
Goods-train traffic ...	294,000	330,000	– 36,000	6,773,000	6,815,000	– 42,000
Total receipts	567,000	549,000	+ 18,000	10,835,000	10,926,000	– 91,000
S.R. (2,148 mls.)						
Passenger-train traffic...	407,000	353,000	+ 54,000	6,285,000	6,341,000	– 56,000
Merchandise, &c. ...	60,000	61,500	– 4,500	1,325,500	1,337,000	– 11,500
Coal and coke ...	26,000	28,500	– 2,500	706,500	721,000	– 14,500
Goods-train traffic ...	86,000	93,000	– 7,000	2,032,000	2,058,000	– 26,000
Total receipts	493,000	446,000	+ 47,000	8,317,000	8,399,000	– 82,000
Liverpool Overhead ... (6½ mls.)	1,342	1,272	+ 70	29,328	26,552	+ 2,776
Mersey (4½ mls.) ...	4,165	4,040	+ 125	96,034	92,666	+ 3,368
*London Passenger Transport Board ...	582,400	585,100	– 2,700	27,617,800	27,021,300	+ 596,500
IRELAND						
Belfast & C.D. (80 mls.) pass.	2,219	2,466	– 247	41,059	43,063	– 2,004
,, ,, goods	314	499	– 185	9,551	10,926	– .,375
,, ,, total	2,533	2,965	– 432	50,610	53,989	– 3,379
Great Northern (543 mls.) pass.	9,850	10,700	– 850	191,700	192,300	– 600
,, ,, goods	9,400	9,800	– 400	192,750	210,550	– 17,800
,, ,, total	19,250	20,500	– 1,250	384,450	402,850	– 18,400
Great Southern (2,076 mls.) pass.	33,482	33,128	+ 354	660,803	652,832	+ 7,971
,, ,, goods	39,695	43,026	– 3,331	871,024	927,161	– 56,137
,, ,, total	73,177	76,154	– 2,977	1,531,827	1,579,993	– 48,166

* 49th week (before pooling)   Whitsuntide bookings, 1938

British and Irish Railway Stocks and Shares

Stocks	Highest 1937	Lowest 1937	Prices	
			June 8, 1938	Rise, Fall
G.W.R.				
Cons. Ord. ...	67 5/8	55 3/4	47 1/2	–1
5% Con. Prefce. ...	127	108	111 1/2	–2
5% Red. Pref. (1950)	113	109	109 1/2	—
4% Deb.	113 5/8	102 1/2	108	—
4¼% Deb.... ...	118	106	111 1/2	—
4½% Deb.	124 1/2	112	117 1/2	—
5% Deb.	136 1/2	122 3/4	129 1/2	—
2½% Deb.... ...	76	64	68 1/2	—
5% Rt. Charge ...	133 7/16	118	127 1/2	—
5% Cons. Guar. ...	133 3/4	116 1/2	125 1/2	–1
L.M.S.R.				
Ord.	36 1/8	25 3/8	16 1/2	
4% Prefce. (1923)	82 1/2	65 3/4	46 1/2	—
4% Prefce. ...	92 1/2	77 3/4	64 1/2	–1/2
5% Red. Pref. (1955)	107 3/4	102	93 1/2*	–5
4% Deb.	108	99 1/4	100*	–1
5% Red. Deb. (1952)	117 1/2	111	111 1/2	—
4% Guar. ...	104	95 7/8	96 1/2	—
L.N.E.R.				
5% Pref. Ord. ...	12 1/2	6 3/4	4 3/4	—
Def. Ord.	6 1/4	3 5/8	2 3/4	–1/8
4% First Prefce.	79 1/2	63	44 1/2	–1 1/2
4% Second Prefce.	31 1/2	21	15	—
5% Red. Pref. (1955)	101 1/4	89 3/4	79 1/2	–1
4% First Guar. ...	103	91 7/8	88 1/2	–1
4% Second Guar.	97 5/8	85 1/2	77 1/2	–2
3% Deb.	84 1/8	74	74*	–1
4% Deb.	107 1/4	98 1/2	99*	–1 1/2
5% Red. Deb. (1947)	113 1/2	106 1/2	109 1/2	—
4½% Sinking Fund Red. Deb.	110 3/16	105 1/2	106*	–2
SOUTHERN				
Pref. Ord.... ...	98 5/8	83 1/2	67	–3
Def. Ord.	27 7/8	16 3/4	17 1/2	—
5% Pref.	126 1/16	105 13/16	108 1/2	–1
5% Red. Pref. (1964)	118	110 1/4	113 1/2	—
5% Guar. Prefce.	133 3/4	116 3/4	125 1/2	–1
5% Red. Guar. Pref. (1957)	118 1/2	111 1/2	115	—
4% Deb.	112	101 1/4	104*	–2
5% Deb.	135 3/4	123 1/2	125 1/2*	–2
4% Red. Deb. 1962–67	113	105	106 1/2*	–2
BELFAST & C.D.				
Ord.	5	4	4	—
FORTH BRIDGE				
4% Deb.	106	99 1/2	100 1/2	—
4% Guar. ...	105 3/4	99	101 1/2	—
G. NORTHERN (IRELAND)				
Ord.	11	5	4 5/8	–1/8
G. SOUTHERN (IRELAND)				
Ord.	50	21 1/2	20	—
Prefce.	61	34	20	–4
Guar.	94 3/4	69 1/2	59 1/2	—
Deb.	95	82 1/8	75	–3
L.P.T.B.				
4½% "A" ...	123 3/4	110 1/2	116	—
5% "A" ...	135	121 1/2	125 1/2	—
4½% "T.F.A." ...	108 3/4	104	106*	—
5% "B" ...	125	114 1/2	116 1/2	–1
"C"	99 3/4	75	75	–1/2
MERSEY				
Ord.	42 3/8	22	19	—
4% Perp. Deb. ...	103	96 3/4	100	—
3% Perp. Deb. ...	77 5/8	74 1/2	74 1/2	—
3% Perp. Prefce.	68 3/4	61 1/4	64	—

* ex-dividend

LEGAL AND OFFICIAL NOTICES

In the Court of the Railway Rates Tribunal.

Road and Rail Traffic Act, 1933

Agreed Charges

NOTICE IS HEREBY GIVEN that Applications for the approval of Agreed Charges under the provisions of Section 37 cf the Road and Rail Traffic Act, 1933, short particulars of which are set out in the Schedule hereto, have been lodged with the Railway Rates Tribunal.

The Procedure to be followed in regard to the inspection of the said Applications and the filing of Notices of Objections is that published in the *London Gazette* of 28th July, 1935.

Printed copies of the Procedure can be obtained from the Railway Rates Tribunal, Bush House, Aldwych, London, W.C.2.

Notices of Objection to any of the said Applications must be filed on or before the 28th June, 1938.

A copy of each Application can be obtained from Mr. G. Cole Deacon, Secretary, Rates and Charges Committee, Fielden House, Great College Street, Westminster, London, S.W.1, price 1s. post free.

T. J. D. ATKINSON,
Registrar.

3rd June, 1938.

Number of Application	Name of Trader and General Description of Traffic
1938—No. 332	R. N. COATE & CO. LTD., Nailsea, Somerset ; Cider, etc.
1938—No. 333	SOUTHPORT CAKES LIMITED, Burscough Bridge, Lancs ; Cakes. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 334	ALLIED NEWSPAPERS LIMITED, 200, Gray's Inn Road, London, W.C.1 ; Returned Unsold Newspapers.
1938—No. 335	ALLIED SUPPLIERS LIMITED, 179–189, City Road, London, E.C.1 ; Provisions. Sugar, etc., ex Cardiff.
1938—No. 336	BELL & SONS LTD , Silverdale Works, Liverpool, 13 ; Cattle Medicines, etc.
1938—No. 337	LAWLEYS LIMITED, 36, Golden Square, London, W.1 ; China, Earthenware, etc.
1938—No. 338	MUNDUS AND J. & J. KOHN LIMITED, 50, Great Eastern Street, London, E.C.2 ; Bentwood Furniture, Chairs and Tables. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 339	G. D. PETERS & CO. LTD., Windsor Works, Slough, Bucks ; Electrodes.
1938—No. 340	ARTHUR TIPPER, Victoria Foundry, Willenhall, Staffs ; Hardware, Malleable Iron Castings and Rivets. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 341	ALLIED SUPPLIERS LIMITED, 179–189, City Road, London, E.C.1 ; Multiple Shop Traffic (Provisions, etc.), ex Paddington.
1938—No. 342	ALLIED SUPPLIERS LIMITED, 179–189, City Road, London, E.C.1 ; Multiple Shop Traffic (Provisions, etc.). ex Broad Street.
1938—No. 343	ALLIED SUPPLIERS LIMITED, 179–189, City Road, London, E.C.1 ; Multiple Shop Traffic (Provisions, etc.), ex Bricklayers' Arms.
1938—No. 344	JAMES JACKSON & CO. LTD., London Works, Rotherham ; Hardware, Metalware, etc.
1938—No. 345	THE ENFIELD HIGHWAY CO-OPERATIVE SOCIETY LIMITED, 112, Ordnance Road, Enfield Wash ; Groceries, Preserves, Provisions, etc.
1938—No. 346	FREEMANS (LONDON, S.W.9) LIMITED, Lavender House, 139–141, Clapham Road, London, S.W.9 ; Clothing, Drapery and General Stores Wares.
1938—No. 347	THE DISTRIBUTERS AND TRANSPORTERS LIMITED (MESSRS. LEVER BROTHERS & UNILEVER LIMITED DISTRIBUTING ORGANISATION), Unilever House, Blackfriars, London, E.C.4 ; Glycerine, ex Port Sunlight and Warrington. (*Applicable to traffic consigned by twelve Associated or Subsidiary Companies.*)
1938—No. 349	JOSEPH BELLAMY & SONS LTD., 12, East Parade, Leeds ; Confectionery.
1938—No. 350	THE BRITISH DIAMALT COMPANY, Sawbridgeworth, Herts ; Malt Flour, Malt Extract, etc.
1938—No. 351	BUTANE LIGHT AND HEAT CO. LTD., 263, Argyll Avenue, Trading Estate, Slough, Bucks ; Butane Gas.
1938—No. 352	THE CHERRY TREE MACHINE CO. LTD., Blackburn ; Washing and Wringing Machines.
1938—No. 353	CECIL COLEMAN LIMITED, 130–146, Pentonville Road, London, N.1 ; Confectionery, Cotton and Rubber Goods, etc.
1938—No. 354	DOVE BROTHERS (BRISTOL) LTD., Castle Green, Bristol ; Paper, Stationery and Paper Bags. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 355	MATTHEW HARVEY & CO. LTD., Glebeland Works, Walsall, Staffs ; Leather Goods, Glassware, Hardware, etc.
1938—No. 356	MARMET LIMITED, Letchworth, Herts ; Perambulators, Invalid Chairs, Electric Signs, etc. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 357	THE METHYLATING CO. LTD., Kinnaird House, Pall Mall East, London, S.W.1 ; Methylated Spirit.
1938—No. 358	NOTTINGHAM MANUFACTURING CO. LTD., Moor Lane, Loughborough ; Hosiery.
1938—No. 359	ROLLS & CO. LTD., College Gardens, Silver Street, Upper Edmonton, London, N.18 ; Distemper, Linseed Oil, Paint, etc.
1938—No. 360	JOHN CARWADINE & SON (BRANCH OF STANDARD CANDLE CO. LTD.) ; Soap, Candle and Oil Works, Bedminster, Bristol, 3 ; Soap, Candles, Oils, etc. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 361	CROSSE & BLACKWELL LIMITED, Soho Square, London, W.1 ; Confectionery, Pickles and Sauces, Preserves, Provisions, etc. (Dundee traffic). (*Applicable also to traffic consigned by six Associated or Subsidiary Companies.*)
1938—No. 362	CROSSE & BLACKWELL LIMITED, Soho Square, London, W.1 ; Confectionery, Pickles and Sauces, Preserves, Provisions, etc. (London traffic). (*Applicable also to traffic consigned by nine Associated or Subsidiary Companies.*)
1938—No. 363	WILLIAM GOODACRE & SONS LTD., Ceylon Mills, Russell Road, Victoria Docks, London, E.16 ; Carpeting, Rugs, etc.
1938—No. 364	L. HARWOOD & CO. LTD., Brearley, Luddendenfoot, Yorks ; Blankets.
1938—No. 365	KITCHENDOM LIMITED, Stadium Works, Wembley, Middlesex ; Kitchen Cabinets and Components, Wardrobe Cupboards, Beds and Bedding, Refrigerators, etc.
1938—No. 366	LAWTON MANUFACTURING CO. LTD., Lawton Works, Roger Street, London, W.C.1 ; Concrete or Plaster Figures and Ornaments. Clocks, Mirrors, etc.
1938—No. 367	NORTHERN ALUMINIUM CO. LTD., Bush House, Aldwych, London, W.C.2 ; Aluminium, etc. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 268	SAXONE SHOE CO. LTD., Kilmarnock ; Boots and Shoes, etc.
1938—No. 369	TAN SAD ALLWIN CORPORATION LIMITED, Great Bridge, Tipton, Staffs ; Perambulators, Invalid Chairs, Toys, Wooden Ladders, etc.
1938—No. 370	UNITED PHOSPHATE & MALT CO. LTD., Chase Road, London, N.W.10 ; Malt Extract, Groceries, Provisions, etc.
1938—No. 371	VITAMINS LIMITED, 23, Upper Mall, Hammersmith, London, W.6 ; "Bemax" and Chocolate.
1938—No. 372	WM. TEACHER & SONS LTD., 14, St. Enoch Square, Glasgow, C.1 ; Wines, Spirits, etc., ex London.
1938—No. 373	WM. TEACHER & SONS LTD., 14, St. Enoch Square, Glasgow, C.1 ; Empties returned to London.
1938—No. 374	WM. TEACHER & SONS LTD., 14, St. Enoch Square, Glasgow, C.1 ; Wines, Spirits, etc., ex Glasgow.
1938—No. 375	WM. TEACHER & SONS LTD., 14, St. Enoch Square, Glasgow, C.1 ; Empties returned to Glasgow.
1938—No. 376	BRINTONS LIMITED, Kidderminster ; Carpets and Rugs.
1938—No. 377	A. J. DEW & CO. LTD., 32–34, Rathbone Place, Oxford Street, London, W.1 ; Motor Car and Motor Cycle Parts, Radio Sets and Electrical Equipment.
1938—No. 378	COLLINS BROS., Mill Street, Evesham ; Cooked Meat, Bacon, Ice, etc.
1938—No. 379	DRING'S LIMITED, 8 to 14, King Street, West Smithfield, London, E.C.1 ; Cooked Meats, Meat Pies and Sausages.
1938—No. 380	J. G. GRAVES LIMITED, Sheffield ; Clothing, Drapery and General Stores Wares.
1938—No. 381	THE GREAT UNIVERSAL STORES LIMITED, Devonshire Street, Ardwick, Manchester ; Clothing, Drapery and General Stores Wares. (*Applicable also to traffic consigned by eight Associated or Subsidiary Companies.*)
1938—No. 382	KELLETT, WOODMAN & CO. LTD., 44, Union Street, Bradford, Yorks ; Textiles.
1938—No. 383	H. SAMUEL LIMITED, Hunters Road Works, Hockley, Birmingham, 19 ; Chinaware, Clocks, Cutlery, etc.
1938—No. 384	WAYNE TANK & PUMP CO. LTD., Wayne Works, Newlands Park, London, S.E.26 ; Petrol Pumps, etc.
1938—No. 385	CAMPBELLS AND STEWARTS & McDONALD LIMITED, 137, Ingram Street, Glasgow ; Clothing, Drapery and Millinery.
1938—No. 386	KEARLEY & TONGE LIMITED, Mitre Square, London, E.C.3 ; Cooked Meats, Brawn and Sausages.
1938—No. 387	THE KETTERING CLOTHING MANUFACTURING CO-OPERATIVE SOCIETY LIMITED, Dryden Street, Kettering ; Clothing.
1938—No. 388	"TWO STEEPLES" LIMITED, Wigston ; Woollen Goods.
1938—No. 389	HANOVIA LIMITED, Bath Road, Cippenham, Slough ; Electric Lamps.
1938—No. 390	ALFRED PIKE LIMITED, Ayr Street Works, Nottingham ; Hosiery.
1938—No. 391	JAMES POTTS & SON LTD., Old Hill, Staffs ; Garden Tools, etc.
1938—No. 392	THE ABIETSAN MANUFACTURING CO. LTD., Concordia Works, Managers Street, London, E.14 ; Perfumery and Toilet Requisites, etc.
1938—No. 393	BRAND & CO. LTD., Mayfair Works, Vauxhall, London, S.W.8 ; Groceries, Preserves, Provisions, etc.
1938—No. 394	NICHOLLS & WILEMAN LIMITED, "Mpyre Works," Earl Shilton, Leicester ; Hosiery.

Sudan Government

SUDAN RAILWAYS require an Engineering Draughtsman, age 30-35 years, preferably unmarried. Candidates must be neat, quick and accurate Draughtsman, with a sound knowledge of Design and Construction, capable of taking out quantities, preparing Specifications and Estimates. Must be A.M.I.C.E. or possess a degree in Civil Engineering and experience in the office of a Civil Engineer. Preference will be given to candidate with Railway or Harbour works experience.

Starting rate of pay £E360-£E396 per annum (£E1 = £1 0s. 6d.), according to age and qualifications, with periodical increases in accordance with Government Scales, viz., £E360—396—432—480—540—600, the first two increases being biennial, and after that triennial.

Successful candidate will be appointed on Probationary Contract for five years and subscribe to Provident Fund, after which, if satisfactory, he will be accepted for pensionable service. If not accepted for pension he will be paid a bonus equivalent to 20 per cent. of the pay drawn between the date of his retirement and the completion of two years' service.

Free passage on appointment. Strict medical examination.

Applications giving full particulars as regards age, qualifications and experience, together with copies of testimonials, should be sent to the Controller, Sudan Government London Office, Wellington House, Buckingham Gate, London, S.W.1, marking envelope "Engineering Draughtsman."

Legal and Official Notices—*continued*

Central Argentine Railway Limited

NOTICE IS HEREBY GIVEN that the Transfer Books of the 4 per cent. Debenture Stock, and the 3½ per cent. Central Debenture Stock of the Company will be closed from the 8th to the 20th June, both days inclusive, for the preparation of Warrants for interest for the half-year ending 30th June, 1938.

RONALD LESLIE,
London Manager and Secretary.

34, Coleman Street,
London, E.C.2.
1st June, 1938.

BRITISH COMPANY having first-class offices and representatives in Roumania, Bulgaria, Turkey, Jugo-Slavia, Hungary, with *entré* to Government and principal contractors, importers and exporters, are desirous securing Agencies for these countries, and solicit enquiries accordingly.—Box 742, Strand House, London, W.C.2.

No. 429,411. "Improvements in Train-carried Devices for Automatically Recording Different Signal Aspects."

THE owners of the above patent are desirous of arranging by licence or otherwise, on reasonable terms, for the manufacture and commercial development of the invention. For particulars address in the first instance to: HERBERT HADDAN & Co., 31 and 32, Bedford Street, Strand, London, W.C.2.

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to:—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

CONTRACTS AND TENDERS

Jessop & Co. Ltd. has received an order from the Indian Stores Department for one electrically-operated single crab overhead travelling crane, 25 tons capacity.

Alfred Herbert Limited has received an order from the Bombay, Baroda & Central India Railway, to the inspection of Messrs. Rendel, Palmer & Tritton, for three belt-driven turret lathes.

Kirchner Co. (London) Ltd. has received orders from the Mysore State Railway Administration for one horizontal slot-boring machine, one universal woodworker, and one single-drum sanding machine, to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

The Vulcan Foundry Limited has received an order from the Central Argentine Railway for 80 locomotive coupling rods.

The Hunslet Engine Co. Ltd. has received orders from the Gondal Railway Administration, to the inspection of Messrs. Robert White & Partners, for the supply of three locomotive boilers, comprising one for "F" class, one for "G" class, and one for "P" class locomotives, and one firebox for "P" class locomotive.

Samuel Osborn (India) Limited has received orders from the Indian Stores Department for 1,100 steel broad-gauge carriage and wagon tyres.

Heatly & Gresham Limited has received an order from the Indian Stores Department for 32 flanged copper tube plates and five flanged copper back plates.

Stahl Union Export G.m.b.H. has received an order from the Antofagasta (Chili) & Bolivia Railway for 80,000 steel sleepers.

Ashok Bros. has received orders from the Indian Stores Department for the supply of 10,000 steel boiler tubes.

Wota India Limited has received orders from the Indian Stores Department for 800 buffer plungers, complete with spindles.

Banting & Tresillian Limited has received an order from the South Indian Railway Administration, to the inspection of Messrs. Robert White & Partners, for the supply of 50 flat and flanged copper plates.

Hugo Lentz & Co. N.V., has, since January, 1936, received orders from the Roumanian State Railways for the supply of Lentz patent poppet valve gear for 116 locomotives, as follow: 10 type G-10, 19 type P-8, 58 type 142, 13 type G-10, 16 type 142. The Railway Administration adopted this gear on the recommendation of a special commission which, after inspecting the locomotives of the most important railways on the Continent, selected it as being the most suitable for the difficult operating conditions existing in Roumania. At the same time type 142 was standardised, this being a copy of the 2-8-4 two-cylinder express locomotive, type 214, of the former Austrian Federal lines. In Austria, 10 further two-cylinder passenger tank locomotives, series 729, and two rack locomotives are to be equipped with Lentz gear, according to orders received quite recently. The last-named contract was placed under the auspices of the German railways, and a Lentz locomotive from Austria is to be tested at Grünewald.

Tubes Limited has received an order from the Buenos Ayres Great Southern Railway for 2,000 steel boiler tubes.

The Britannia Engineering Co. Ltd. has received orders from the Indian Stores Department for 400 standard screw couplings and 100 high-tensile screw couplings.

J. O'Hara Murray (India) & Co. Ltd. has received orders from the Indian Stores Department for 3,000 screw couplings without hook, shackle pin, pin collar, and rivet; and 460 screw couplings, complete.

Worthington-Simpson Limited has received an order from the Buenos Ayres Great Southern Railway for 10 horizontal centrifugal pumps.

Edgar Allen & Sons Ltd. has received an order from the Buenos Ayres Western Railway for 18 rolled manganese steel crossings.

The Lithuanian State Railways Administration is reported to have purchased 40,000 tons of Durham steam coals and 30,000 tons of Northumberland steam coals for May-February shipment.

Alfred Herbert (India) Limited has received an order from the Indian Stores Department for one portable centrifugal sand cleaning, mixing, and aerating machine.

Leyland Motors Limited has received the following orders from railway and railway-associated road transport operators:—

Lincolnshire Road Car Co. Ltd.: Two oil-engined Titans.
Great Southern Railways (Eire): Twelve oil-engined Tigers and 23 Lions.
Lincolnshire Road Car Co. Ltd.: Eight oil-engined Tigers.
Scottish Motor Traction Co. Ltd.: Six Lynx goods vehicles.

Stewarts and Lloyds Limited has received an order from the Buenos Ayres Great Southern Railway for 4,200 steel boiler tubes.

G.W.R. Works to be Undertaken

Hullavington.—The working at Hullavington is to be expedited by the installation of track circuiting and the adoption of signalling improvements.

Newport (East Usk Branch).—As a result of industrial activity in the neighbourhood there has been a considerable increase in the traffic using the East Usk branch, and it is anticipated this will continue. It is therefore proposed to improve the track and strengthen two bridges to admit of the employment of heavier engines on the branch.

Swindon Locomotive Works.—The machinery for dealing with the tube expanding plant is to be rearranged and a portion is being transferred from the "V" (Boiler) Shop to the "P1" (Boiler Mounting Shop).

A part of the stores in the "L2" (Tank) Shop is to be transferred to the "L2" Shop Extension, to make room for the better lay-out of new machinery.

Teignmouth.—During the summer season, and especially at week-ends, many of the excursion and other long trains calling at Teignmouth have to draw up twice, and to obviate this the down platform is to be extended by nearly 400 ft.

Railway Share Market

Since the commencement of the new Stock Exchange account the stock and share markets have developed a steadier appearance and the downward movement in values appears to have been checked. On the other hand, little improvement in the volume of business was reported and movements in favour of holders were very moderate.

Home railway stocks were not unresponsive to the steadier trend of markets and in a number of cases prices are better than at the beginning of the week. The past week's traffics, which reflect partial benefits of the Whitsun holiday period, created a satisfactory impression, although they were below market expectations as the figures relating to coal and goods receipts were again disappointing. Owing to the better passenger takings, the past week's traffics show an aggregate increase of £118,000, which reduces the total decrease to £924,000 for the current year to date. In the case of the L.M.S.R. the week's receipts increased by £71,000 and the ordinary stock received rather more attention up to 16¾, while the 4 per cent. 1923 preference was more active around 46, as was the 4 per cent. preference at 64½. Great Western ordinary developed an improved tendency at 48, on the more general belief that a minimum dividend of 3 per cent. is likely for the current year. Southern deferred was in request at 17½ on satisfaction with the past week's traffic gain of £47,000 and on the view that, as the railway is essentially a passenger-carrying line, its receipts should continue to increase during the next few months, granted weather conditions are favourable. The preferred ordinary stock was in better request at 67½, attention being drawn to the apparently attractive yield. On the other hand, L.N.E.R. securities were relatively dull, although the second preference at 14¼ was slightly better than earlier in the week, despite disappointment with the £18,000 decrease shown by the traffic return. London Transport "C" at 74½ failed to attract much business. Guaranteed stocks were firmer, while debenture stocks were inclined to make higher prices in sympathy with the trend in British Government securities.

More attention has been given to foreign railway stocks. Although rumours that before long the Argentine Government may propose to nationalise the leading Argentine railways were denied in responsible market quarters, reports have been current that a plan may eventually be brought forward to merge the leading companies with a view to effecting economies. Central Argentine, B.A. Gt. Southern and other ordinary stocks of the big lines were better in price and more business was also reported in the preference stocks and debentures. Elsewhere, Antofagasta and Nitrate Rails were lower. Canadian Pacific showed a rather firmer tendency at around 5⅝.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1937-38	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1937	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1937	Prices: Lowest 1937	Prices: June 8, 1938	Prices: Yield % (See Note)
				£	£		£	£	£					
South & Central America	Antofagasta (Chili) & Bolivia	834	5.6.38	14,520	+ 20	23	378,550	382,330	− 3,780	Ord. Stk.	29	10¼	10½	Nil
	Argentine North Eastern	753	4.6.38	12,432	+ 918	49	449,503	432,362	+ 17,141	,,	19¼	6	6	Nil
	Argentine Transandine	—	—	—	—	—	—	—	—	A. Deb.	93½	60	90§	4 7/16
	Bolivar	174	May, 1938	3,450	− 2,650	22	19,050	29,300	− 10,250	6 p.c. Deb.	9½	5	8½	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	17	9	5	10
	Buenos Ayres & Pacific	2,806	4.6.38	81,750	− 28,784	49	4,324,448	4,715,552	− 391,104	Ord. Stk.	17⅛	5½	5	Nil
	Buenos Ayres Central	190	21.5.38	$105,900	− $30,400	47	$5,354,100	$6,543,200	− $1,189,100	Mt. Deb.	41½	18	11½	Nil
	Buenos Ayres Gt. Southern	5,084	4.6.38	132,630	+ 4,590	49	7,283,062	7,306,346	− 23,284	Ord. Stk.	33¾	13½	12½	Nil
	Buenos Ayres Western	1,930	4.6.38	39,640	− 7,755	49	2,210,360	2,452,436	− 242,076	,,	31¾	11¼	9	Nil
	Central Argentine	3,700	4.6.38	104,414	− 54,913	49	5,835,807	7,521,373	− 1,685,566	,,	34¼	10¾	10	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	20½	4½	4	Nil
	Cent. Uruguay of M. Video	972	28.5.38	22,174	+ 2,691	48	882,738	855,012	+ 27,723	Ord. Stk.	6 7/32	2	2	Nil
	Cordoba Central	1,218	—	—	—	—	—	—	—	Ord. Inc.	6¼	1½	3	Nil
	Costa Rica	188	Mar., 1938	33,015	+ 6,498	39	233,338	171,651	+ 61,687	Stk.	38	27	26½	7 9/16
	Dorada	70	Apr., 1938	14,100	− 300	18	60,900	62,400	− 1,500	1 Mt. Db.	107	106	106	5⅝
	Entre Rios	810	4.6.38	15,912	+ 490	49	698,899	630,475	+ 68,424	Ord. Stk.	19 7/16	6	5	Nil
	Great Western of Brazil	1,092	4.6.38	5,400	− 1,100	23	163,500	173,400	− 9,900	Ord. Sh.	¾	⅛	¼	Nil
	International of Cl. Amer.	794	Apr., 1938	$523,864	− $37,036	18	$2,056,786	$2,181,008	− $124,222	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1st Pref.	2/-	1/-	½	Nil
	La Guaira & Caracas	22½	May, 1938	5,905	+ 650	22	25,635	28,335	− 2,700	Stk.	8½	6	8½	Nil
	Leopoldina	1,918	4.6.38	17,061	− 8,459	23	407,857	498,451	− 90,594	Ord. Stk.	9¼	3	2	Nil
	Mexican	483	31.5.38	$470,900	+ $3,100	22	$6,688,600	$6,806,600	− $118,000	,,	1½	¼	3/16	Nil
	Midland of Uruguay	319	Apr., 1938	9,614	+ 888	44	95,899	87,736	+ 8,163	,,	1⅞	½	½	Nil
	Nitrate	386	31.5.38	4,001	+ 271	22	73,026	74,705	− 1,679	Ord. Sh.	3 1/16	2	1¾	5 11/16
	Paraguay Central	274	28.5.38	$5,029,000	+ $895,000	48	$153,553,000	$143,057,000	+ $10,496,000	Pr. Li. Stk.	84	79¼	62½	9⅝
	Peruvian Corporation	1,059	May, 1938	68,538	− 11,718	48	879,402	908,145	− 28,743	Pref.	14¾	4½	2½	Nil
	Salvador	100	28.5.38	¢12,170	− ¢7,030	48	¢942,495	¢1,162,458	− ¢219,963	Pr. Li. Db.	23½	21½	22½	Nil
	San Paulo	153½	29.5.38	32,262	− 5,112	22	658,759	679,932	− 21,173	Ord. Stk.	98½	56	41	9¾
	Taltal	160	May, 1938	1,820	− 1,490	48	36,805	37,920	− 1,115	Ord. Sh.	1 7/16	11/16	¾	13 5/16
	United of Havana	1,353	4.6.38	16,761	− 321	49	1,202,634	1,332,235	− 129,601	Ord. Stk.	5⅝	31/32	2	Nil
	Uruguay Northern	73	Apr., 1938	1,002	+ 161	44	9,462	10,134	− 672	Deb. Stk.	10	2	2	Nil
Canada	Canadian National	23,781	31.5.38	872,654	− 170,959	22	13,811,463	15,730,882	− 1,969,419	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	77	62½	62½§	6⅞
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	101⅞	94½	102½§	3⅞
	Canadian Pacific	17,186	31.5.38	686,000	− 66,600	22	10,228,400	11,074,200	− 845,800	Ord. Stk.	18	7¼	5½	Nil
India†	Assam Bengal	1,329	10.5.38	35,662	+ 1,334	6	144,292	142,896	+ 1,396	Ord. Stk.	86	73½	79	3 15/16
	Barsi Light	202	20.5.38	3,832	+ 870	7	21,495	19,230	+ 2,265	Ord. Sh.	66½	46	60	8 5/16
	Bengal & North Western	2,116	20.5.38	89,470	− 7,555	7	444,649	475,717	− 31,068	Ord. Stk.	317	301	298½	6
	Bengal Dooars & Extension	161	20.5.38	3,199	+ 135	7	17,077	16,280	+ 797	,,	100	84	85½	7
	Bengal-Nagpur	3,268	20.5.38	199,200	+ 1,878	7	999,675	1,036,654	− 36,979	,,	101	89	90½§	4 7/16
	Bombay, Baroda & Cl. India	3,072	20.5.38	277,275	+ 6,675	7	1,398,750	1,432,500	− 33,750	,,	113	110½	110½	5 7/16
	Madras & Southern Mahratta	2,967	20.5.38	166,875	+ 7,310	7	819,000	802,998	+ 16,002	,,	110	105	106½	8 7/16
	Rohilkund & Kumaon	571	20.5.38	17,854	+ 748	7	91,568	96,038	− 4,470	,,	314	302	304½	5 15/16
	South Indian	2,531½	10.5.38	118,791	+ 105	6	466,028	476,641	− 10,613	,,	103½	99½	101½§	4 11/16
Various	Beira-Umtali	204	Mar., 1938	84,833	− 656	26	528,588	418,485	+ 110,103	—	—	—	—	—
	Egyptian Delta	620	20.5.38	5,304	− 234	7	28,348	28,631	− 283	Prf. Sh.	31/-	¾	¾	Nil
	Kenya & Uganda	1,625	Apr., 1938	259,306	− 9,240	18	1,061,463	1,121,525	− 60,062	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb	48⅛	43½	43	8⅛
	Midland of W. Australia	277	Apr., 1938	16,585	+ 3,533	44	147,590	132,650	+ 14,940	Inc. Deb.	98	93½	93½§	4¼
	Nigerian	1,900	16.4.38	33,665	− 37,975	3	74,295	187,359	− 113,064	—	—	—	—	—
	Rhodesia	2,442	Mar., 1938	410,494	+ 564	26	2,512,028	2,109,905	+ 402,123	—	—	—	—	—
	South Africa	13,263	21.5.38	601,936	− 25,428	8	4,435,684	4,497,751	− 62,067	—	—	—	—	—
	Victoria	4,774	Mar., 1938	902,439	− 25,935	39	7,294,911	7,634,217	− 339,306	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements are based on the current rates of exchange and not on the par value

Diesel Railway Traction

Oil Engines in the East

THE considerable advance in diesel traction in Japan and Manchukuo, more particularly on secondary railways, has been made with the assistance of a number of Japanese-built oil engines ranging from 65 to 750 b.h.p. Most of these engines are modelled on European designs, but some attention has been paid to modifications enabling the engines to run on the variety of fuels normally met with in Japan. Despite the closeness with which European practice has been followed, the fuel consumptions obtained in the small high-speed engines of 100 to 130 b.h.p. are not all that could be desired; but such a result is only what might be expected, for even builders who have had a complete set of drawings presented to them have found that some time must elapse before they can turn out a succession of well-made engines. The consumptions now regarded as standard by Japanese makers are of a magnitude which would hardly be published by a European builder. For example, one engine rated at 100 b.h.p. at 1,600 r.p.m. has a consumption of 0·48 lb. per b.h.p.hr. and no less than 0·5 lb. per b.h.p.hr. when the output is 125 to 130 b.h.p. at 2,000 r.p.m. It appears that the fuel injection apparatus is being made in Japan in most instances, and it may be in this direction that a great improvement could be made, for it takes years of extremely specialised work to turn out fuel pumps and nozzles of consistently high-class quality. Japanese diesel-building is in its infancy, but with the help of government subsidies for research and the vast market for such engines in the East, it is likely that future development will be extremely intense.

Interurban Diesels

THERE still appears to be a general opinion that heavy steam trains cannot be replaced by railcars, but nevertheless there are many examples where this is being done successfully. The capacity of a single railcar is not sufficient for it to replace a steam train of respectable length if that train is being respectably patronised, but if no changes in operating methods are to be made—and this in itself would be surprising—a trailer can be attached, or a twin or triple-car diesel train used, and, where necessary, two or more rakes coupled in multiple-unit, as is done in Holland. This replacement of heavy steam trains by diesels has been developed to a wide extent in Germany, particularly in the fields of short and medium distance interurban traffic. Compared with steam trains the seats per railcar train are not quite so numerous, but the service is more frequent and is run to standard timings, which is what the public wants. The Reichsbahn is systematically substituting railcar traction for steam trains in districts with heavy traffic, for although the total operating expenses of running many light diesel trains is greater than that of operating a few heavy steam trains, the revenue has proved to increase at a more rapid rate. Between Frankfort, Mainz, Wiesbaden, and Darmstadt, as an example, frequent services are worked by 400-420 b.h.p. diesel-electric railcars each coupled to a driving trailer. In the even more populous Ruhr area where, incidentally, use has been made of battery railcars for many years, similar trains have been adopted in part, and in periods of peak traffic two railcars and two driving trailers are coupled together in multiple-unit. But for the connection of the seven biggest towns of the Ruhr, with an average population of about half-a-million, three-car and four-car set trains of 800 b.h.p. or more have been built, and if traffic necessitates they are coupled in multiple-unit. In certain cases where there is a heavy traffic in mails, parcels, and light goods, the luggage compartment of the railcar or railcar-train has been enlarged to cope with all the traffic offered. Similar intensive interurban railcar services, carrying nearly all the passenger and parcels traffic, are in operation between Lyons and Grenoble in France, and others, forming a smaller proportion of the total train service, are to be found in Belgium between Brussels and most of the important industrial towns.

Engine Bearings

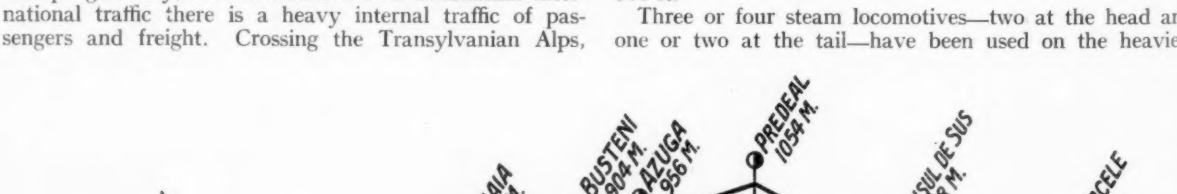
IT is well known how in similar services one make of engine will give practically no bearing troubles while another will need constant attention to prevent failures from this source. Bearing design, manufacture and application appear to be analogous to a locomotive in that they have simply grown up without a great number of fundamental facts being known about them. But if one thing more than another arose from the recent informal discussion on bearing metals at the Diesel Engine Users Association, it was that this state of things was not going to be allowed to continue, and that intensive research work was proceeding over a wide field. It is remarkable how almost exactly opposite results have been obtained with bearing metals having the same base. It has often been reported, particularly in North America, that extremely good results have been given consistently by cadmium base metals, but in the D.E.U.A. discussion Mr. B. F. Baker said that in this country his firm had virtually given up the use of cadmium, due mainly to difficulties associated with its high thermal contraction. Lead-base bearings, with 96 to 98 per cent. of that metal, have given extremely good service in two-stroke engines installed in some of the American high-speed trains. It is not improbable that some of the bearing troubles met with in certain railway applications are due to the relatively frequent stopping and starting of the engine, and in this connection we may draw attention to the electrically-driven oil pump for priming on a cold start the bearings and lubrication points of the 4,400 b.h.p. Roumanian diesel locomotive described in this issue. It is important to view the design and assembly of the bearing as a whole, but here, just as much as in the actual composition of the metal, opinions and practices are numerous, and there is no universal idea, for example, as to just where and how the grooves should be located. When viewing the bearing assembly it is necessary also to take into account the journal and the steel of which it is made. Although, in general, certain steels seem to assist a freedom from bearing and journal wear troubles, others, such as nitrided steel, still give most variable results.

4,000-B.H.P. DIESEL LOCOMOTIVE FOR MOUNTAIN LINE

Roumanian diesel locomotive on test train at Wil, Swiss Federal Railways

CONSIDERABLE difficulty has always been experienced in operating the section of the Roumanian State Railways between Campina and Brassov. It forms part of one of the main traffic arteries between the Roumanian capital, Bucharest, and Hungary and Central Europe generally, and in addition to a substantial international traffic there is a heavy internal traffic of passengers and freight. Crossing the Transylvanian Alps, the line has long grades of 1 in 40 to 1 in 50, combined with uncompensated curves of 900 ft. radius, and to add to the operating difficulties the track is single. Two-thirds of the distance between Timisul de Sus and Predeal (see gradient profile) is curved, and most of it at a radius of 900 ft.

Three or four steam locomotives—two at the head and one or two at the tail—have been used on the heaviest

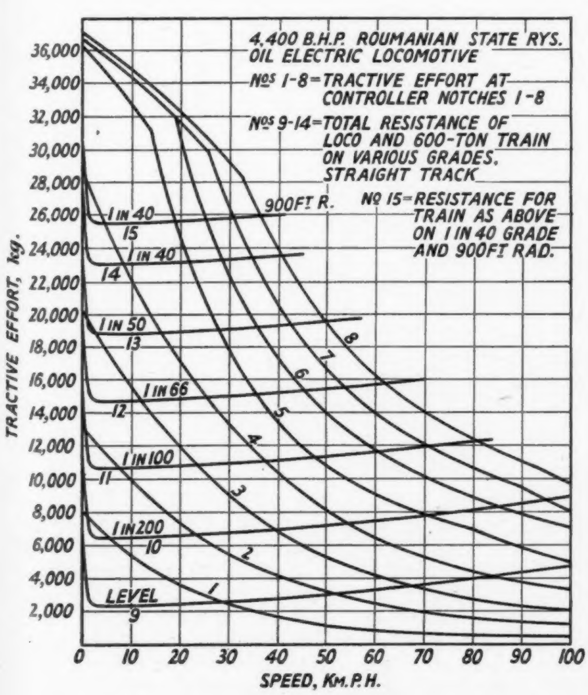


Profile of main line over the Transylvanian Alps on the Bucharest-Hungary route

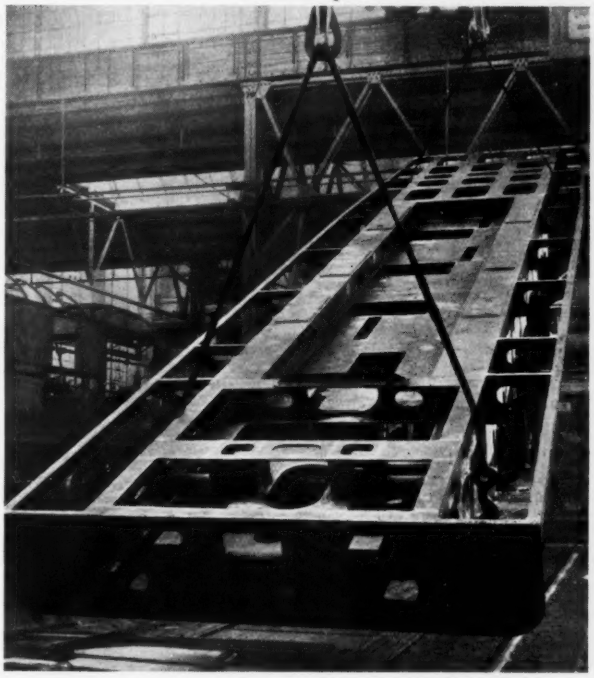
trains for some years. Doubling the line or modernising alternative routes have been considered as means of easing the working, and also electrification, which a few years ago had been virtually sanctioned, but the high prices of the conversion tenders caused this project to be postponed indefinitely. The only other alternative was diesel traction; it was felt that high-power diesel locomotives would eliminate double-heading at each end of the train, save a considerable amount of money in crew wages, locomotive maintenance, locomotive running expenses, and track and building maintenance, and would also eliminate the smoke nuisance and enable the national fuel —oil—to be used.

If double-heading was not to be permitted—even with the heaviest trains—it was obvious that an extremely large diesel locomotive would be required, and it must have needed a good deal of courage—perhaps born of desperation—to order such a unit for trial purposes nearly two years ago. Preliminary calculations showed that to handle unassisted 600-ton trains over the 44-mile section between Campina and Brassov would require an engine output of at least 4,000 b.h.p. if a reasonable speed was to be maintained up the steepest grade, and if this load had to be started with certainty from a signal stop on the most difficult portion. The high tractive effort required for these conditions coupled with the specified maximum axle load of 20 *tonnes* (which, incidentally was 2 *tonnes* more than that allowed to steam locomotives, owing to the elimination of hammer blow) necessitated eight driving axles, and this in combination with the size of the two power plants which would obviously have to be installed to provide such an output, at once involved the division of the locomotive into two parts.

Thus the standard-gauge oil-electric locomotive ordered from Sulzer Brothers, of Winterthur, and just delivered after trials in Switzerland last month, is of the 2-Do-1+1-Do-2 wheel arrangement and is powered by two Sulzer 12-cylinder 2,200 b.h.p. engines. The two halves cannot be used as separate locomotives without alteration to the



Speed-tractive effort curves of C.F.R. locomotive



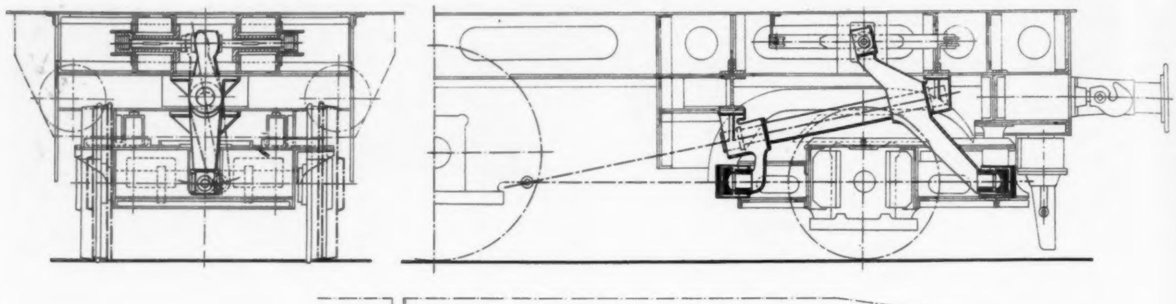
Welded steel framework of one-half of the complete locomotive

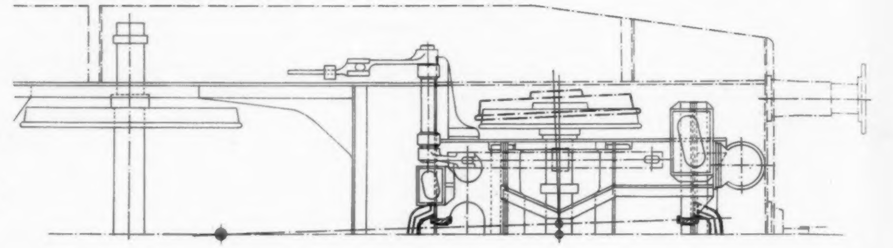
drawgear and buffers. Nevertheless the two halves are identical, although some saving in money and weight could have been made by having only one driving position, one battery, and simplified control. This principle of duplication was carried out because the construction of further locomotives is envisaged, until all the traffic over the Campina—Brassov line is hauled by diesel locomotives, and it was thought desirable that any two halves from different locomotives should be capable of being coupled together.

As built, the locomotive has a full working order weight of 230 tons, combined with a maximum axle load of 19 tons. The light weight is 218 tons and the adhesion weight in this condition 148 tons. Considerable attention was given in the design to prevent variation in the adhesion weight as the tanks are emptied, and the maximum difference over the whole engine is only 4 tons. The peak starting tractive effort is 81,500 lb., giving a factor of adhesion of 4·05 against the lowest weight on the driving wheels. As may be seen from the accompanying speed-tractive effort curves, the power is ample to handle a 600-ton train over the worst section of line, and is enough for a speed of 22 m.p.h. to be maintained with this trailing load over 1 in 40 grades and 900 ft. uncompensated curves. On the one-hour rating of the electric transmission equipment the tractive effort at the wheel rims is 53,800 lb. at 20·8 m.p.h., and on the continuous rating 38,400 lb. at 29·8 m.p.h. To meet Roumanian conditions the maximum service speed is 62 m.p.h., and when operating at this speed under the full power of 4,400 b.h.p. the tractive effort at the wheel rims is 21,500 lb., which is equivalent to the haulage of a 600-ton train up a straight 1 in 200 grade.

Mechanical Portion

The complete mechanical equipment was made at the Kassel works of Henschel & Sohn A.G., and was taken on its own wheels to Munchenstein, near Basle, where in





Drawing showing a general application of the Henschel two-wheeled truck. In the Roumanian locomotive the lateral control springs are of the volute type

the erecting shops of Brown Boveri & Co. Ltd. the power and transmission plants were installed.

Each **14**-wheeled half locomotive is built up on a welded steel framework incorporating seatings and supports for the engine-generator set. The main side plates are **26** mm. thick, and they are very rigidly stayed by a horizontal stretcher located below the engine sump and by a number of vertical cross stretchers, **10**, **12** and **15** mm. thick, some of which incidentally support the traction motors. The outer buffers and drawgear are to Roumanian standards, but the buffers are fitted with Uerdinger ring springs. The drawbars are about **7** ft. **6** in. long and the pull is taken through helical steel springs bearing against the cross stretcher carrying the bogie pivot. Between the two half units there is a single rigid drawbar and spring side buffers with hemispherical faces, one being concave and the other convex on each side. By this means the oscillatory movements of a half unit relative to the other are cushioned. Cowcatchers of steel bar are fitted at the outer ends, and small screwjacks are carried just behind the buffer beams.

The body of each half locomotive is divided into a driving cabin, a generator compartment and an engine room. There is a wide passage-way down each side of the engine, and at the inner end these two join to form a central gangway under the radiator fans. Connecting the two halves are the usual fall plates and canvas bellows. The whole centre portion of the roof over the engine room is removable so that the main engine can be withdrawn or installed en bloc. In this portion of the roof, and extending over the fixed part of the roof into the generator compartment are long hinged side ventilators which can be opened under air pressure from a cock at cantrail level to increase the ventilation of the engine and generator rooms during hot weather. All the windows down the side of the engine room are of the sliding type and are protected by iron grilles.

At the extreme ends of the locomotive, within separate compartments formed in the body, are located the batteries. These battery chambers are ventilated from outside, and have hinged doors on the front and sides, but two vents project from the top of the battery box through the front of the driving control desk. Standing vertically behind the battery box are two **85**-litre air reservoirs for the supply to the electro-pneumatic control system and other apparatus. The exigencies of the weather in Roumania, very hot in summer and cold in winter, have necessitated the provision of a window-warmer to prevent the formation of ice on the end window, a foot-warming plate, a wall-heater, and a ventilating fan on the driving desk. The side doors have drop lights and on these a white bar is painted, giving instantaneous indication as to whether the light is up or down. The front windows are of Sekurit glass.

The driving wheels have a diameter of **53** in. and are forced on to hollow-bored alloy steel axles which are carried in Peyinghaus Isothermos boxes. These boxes are supported by **16**-plate overhung laminated springs which are equalised in one group down each side of a half unit. No sideplay has been given to the axles, but to assist the locomotive to run easily through **900** ft. curves on the line and through **1** in **8** turnouts in stations and sidings, the flanges of the two inner pairs of driving wheels in each half unit have been thinned by **15** mm. The four-wheeled carrying bogie has **39$\frac{5}{8}$** in. wheels and the lateral movement is controlled by the cumulative action of laminated springs at each side connected together by links. A hemispherical central pivot and flat side-bearers are used, and the pivot has a maximum displacement of **3$\frac{3}{4}$** in. per side. On the inner headstock of the bogies is a bracket bearing against horizontal helical springs, working between stops on one of the main frame cross stretchers, and these springs tend to damp out any hunting movements set up in the bogie on straight track. Peyinghaus-Isothermos boxes are used for the bogie axles and they have independent overhung laminated springs with helical steel auxiliaries. Attached to the front of the bogie frame against the guard irons are wire brushes for cleaning the rails, and applied to the leading wheels are Friedmann's automatic flange lubricators. For the lubrication of the bogie itself there are special drip lubricators with the oil boxes arranged in groups in the engine room, where they can be easily filled.

The single-axle inner truck of each half unit is to a design evolved by Henschel and which has been tried already on the German State Railway's **E.05** class of electric locomotive. It is similar in action to a Bissel, but contrary to the conventional type with a radius bar swinging about a pivot on the main frame, the new truck has a theoretical pivotal point only. On a control shaft which is arranged slantingly in the longitudinal centre plane of the locomotive is shrunk a long front control lever and a short rear control lever. The ends of these levers come level with the carrying axle centre line when the truck is in normal running position. The line connecting the lever ends intersects the centre line of the

control shaft in the imaginary pivoted point of the truck; the lever system, therefore, connects the truck with the engine main frame in the same manner as though a tapered bearing was used. The ends of the control levers are supported axlebox fashion in the truck frame so that the latter can participate in their movement in the horizontal plane only, not in the vertical plane. When the control shaft oscillates on a track curve the track therefore follows the horizontal projection of the line connecting the lever ends. As the latter always passes through the vertex of the cone and, consequently, through the imaginary pivotal point, the truck acts in the same way as a Bissel. The long control lever also takes part in the lateral control of the truck. Its upper end is connected to two sets of volute springs (in certain other applications laminated springs are used), and as the truck moves over the lever turns about the control shaft and compresses the springs; the leverage is such as to make the control springs exert the same effort as if the springs were attached directly to the bogie frame in the conventional manner.

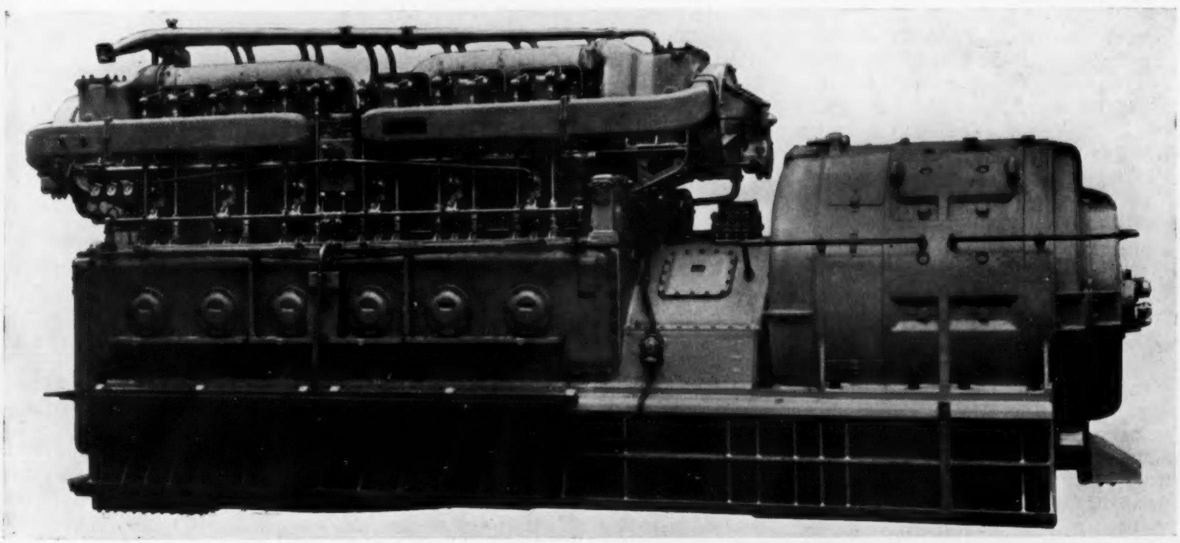
In its way the brake gear is a poem. Despite the incorporation of four different systems, and with blocks on 24 of the 28 wheels, all the rigging and the cylinders except the tops of the hangers, the blocks and the cross ties, are outside the frames, and the very large range of adjustment for individual blocks can be used without going into a pit. The rigging is compensated to give equal pressures on all blocks and the pull rods have screw adjustment for taking up small amounts of wear and multi-hole eyes for use when the blocks are getting thin.

Westinghouse brakes are used, and the cylinder for the driving wheel blocks down each side of a half unit is mounted on the outside of the main frame just above the inner bogie wheel, and the piston rod is connected directly to the primary lever on the brake shaft. The four-wheeled bogie has a cylinder mounted on its frame at each side and this actuates through levers a single block on each wheel on that side. The main constituents of the complete Westinghouse equipment are an automatic brake applying, on the locomotive, two blocks on each driving wheel and one block on each wheel of the bogies; a hand-controlled regulating air brake operating only the blocks on the driving wheels, and used for holding the locomotive to a steady speed on down grades; and a special air brake used at a low pressure in conjunction with the air sanding apparatus, its function being to just hold the driving wheels from slipping when starting with maximum current. This equipment was considered desirable in view of the high starting effort of 81,500 lb. and the maximum factor of adhesion of 4·17. With the automatic system in operation the braking force is 77 per cent. of the weight on the driving axles plus 60 per cent. of that on the bogie with the maximum cylinder pressure of 50 lb. per sq. in. With the regulating brake the maximum cylinder pressure is 36 lb. per sq. in., and a still lower pressure is used for the special starting brake. A hand brake is incorporated and applies the blocks on the driving wheels only, with a maximum force equivalent to 40 per cent. of the adhesion weight. The truck wheels are unbraked. Air is supplied by two Oerlikon motor-driven compressors located one on the floor of each generator compartment. Each has a delivery capacity of 1,600 litres a min. and is driven by a 15 h.p. 205/175-volt 75-amp. motor running at a top speed of 2,100 r.p.m.

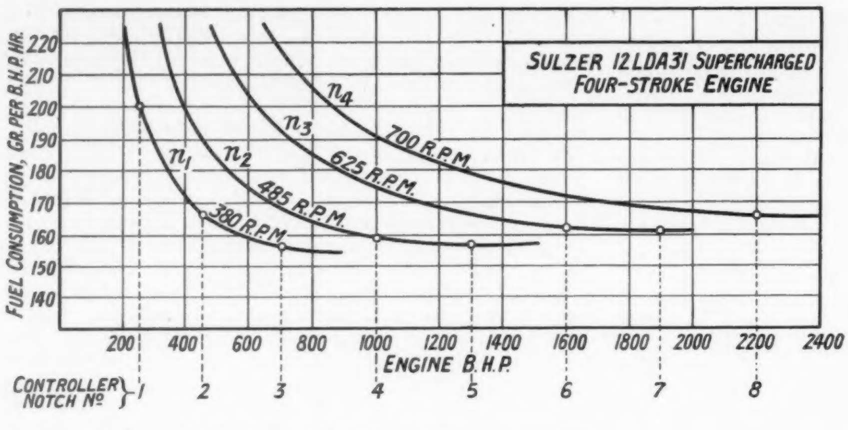
Engine Equipment

The Sulzer engine installed in each half of the locomotive is of the maker's 12LDA31 type, which has been in service for the past 12 months on the P.L.M. Railways' (now S.E. Division of the French National Railways) first express oil-electric locomotive of 4,400 b.h.p. It has two vertical banks of six cylinders, each with its own crankshaft, and driving a single main generator through spur gears with a step-up ratio. The twelve cylinders are 310 mm. by 390 mm. (12·2 in. by 15·4 in.), and with the Büchi supercharger in operation they give a one-hour rated output of 2,200 b.h.p. at 700 r.p.m., this figure being at the output side of the step-up gears. Actually this figure has been maintained for over two hours, and a peak of 2,500 b.h.p. has been attained without difficulty and without the fuel consumption exceeding 170 gr. per b.h.p.hr. (0·375 lb. per b.h.p.hr.). The compression pressure is about 48 kg. per sq. cm. (670 lb. per sq. in.) and the maximum cylinder pressure about 58 kg. per sq. cm. (820 lb. per sq. in.). Indicator cards taken at and near full load show a decided constant-pressure combustion shape.

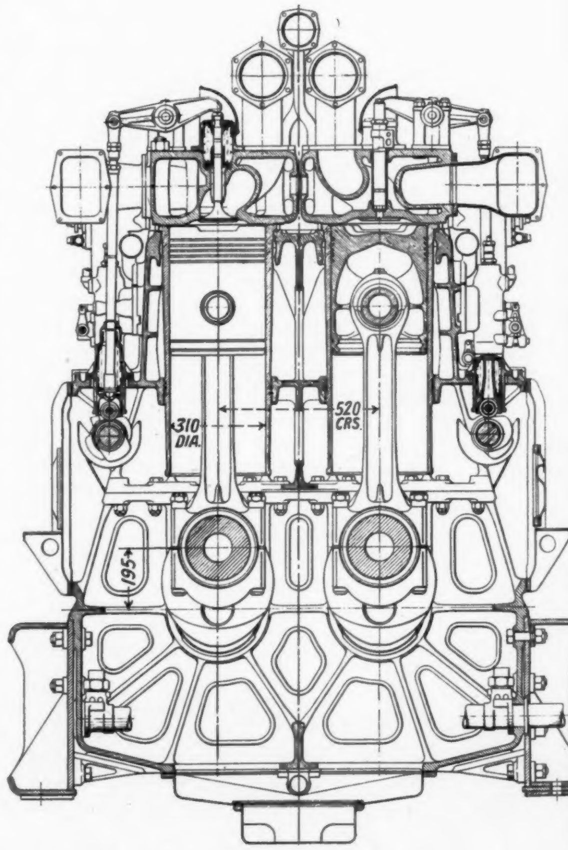
Without superchargers the engine measures about 4·2 m. (13 ft. 10 in.) long, 1·9 m. (6 ft. 3 in.) high above



2,200 b.h.p. Sulzer four-stroke 12-cylinder engine, with Büchi superchargers, step-up gears, and main generator on a common underbed



Left**: Fuel consumption curves at the four governed engine speeds**



Below**: Cross-section of Sulzer 12-cylinder twin-bank engine developing 2,200 b.h.p. at 700 r.p.m. with Büchi superchargers in operation**

the crankshaft and 1·1 mm. (3 ft. 8 in.) below, and 1·95 m. (6 ft. 5 in.) wide. Its weight empty, but with welded steel underbed carrying the engine, step-up gears, and main generator, is 23 tons, or 11·45 kg. (25·3 lb.) per b.h.p. Exclusive of this underframe the weight is about 21 tons, corresponding to 9·7 kg. (21½ lb.) per b.h.p. At the normal full load rating of 2,200 b.h.p. at 700 r.p.m. the piston speed is 1,795 ft. per min. and the brake m.e.p. 115 lb. per sq. in. On what is called the continuous rating of 1,900 b.h.p. at 625 r.p.m. (although it is obvious from the actual performance of the engine that for railway purposes 2,200 b.h.p. at 700 r.p.m. can be considered the continuous output) the piston speed is 1,600 ft. per min. and the brake m.e.p. 112 lb. per sq. in.

From the accompanying fuel consumption curves it will be seen that at all working speeds and powers the fuel consumption is below 175 gr. (0·385 lb.) per b.h.p.hr., and that the curves at each governed speed are almost flat over the power range at which that speed will normally be employed, this, of course, being a common characteristic of well-designed supercharged engines. But the actual consumptions are amazingly low and it is probable that never before has a railway oil engine shown on a regular working notch a consumption of 157 gr. (0·346 lb.) per b.h.p.hr. Assuming fuel oil with a calorific value of 19,000 b.t.u.'s per lb., this consumption is equivalent to a brake thermal efficiency of 36·5 per cent. If the third governed speed of 625 r.p.m. is taken as the one likely to be used most in actual service, it will be seen by a reference to the curves that over a power range of 1,100 to 2,000 b.h.p., covering all normal requirements on this speed, the fuel consumption does not rise above 170 gr. (0·375 lb.) per b.h.p.hr. The guarantee required by the administration of the Roumanian State Railways was for a minimum full load consumption of 186 gr. (0·41 lb.) per b.h.p.hr., but the engine performance and control arrangements are such that nothing like this figure would be reached except at extremely small loads. The engine is controlled to run at four speeds, *viz.*, 380, 485, 625, and 700 r.p.m. with respective maximum outputs of 2,200, 1,900, 1,300, and 700 b.h.p. with the superchargers in operation.

The crankcase is a single steel casting covering both rows of cylinders and carrying an extension for the two primary wheels of the generator gear drive. Double-U shaped cross members of the casting support the main bearings of both shafts and are connected to the cylinder block through bolts. The bearing caps are held in position by double taper keys located in the cross members and with a locking device at each side. Lubricating oil is led to the main bearings through passages drilled in the ribs of the crankcase, so that the risk of interruption in the oil supply, through the breakage of pipes, is eliminated. On each side of the crankcase are three large inspection doors, and on each of these are two circular hand holes for the observation of the bearings and big ends. The crankcase rests on a welded steel underbed consisting of two independent longitudinal beams, which are common to the engine and generator. Hinged chequered plates are fitted to the top of the underframe at the sides, and lift up to the horizontal position so that a man standing on them can easily inspect the rocker gear. A grab handrail runs round the engine and generator. The crankcase is carried well up above the centre line of the crankshaft, and to the top of it is bolted the cylinder block which consists of two six-cylinder steel castings welded together at the transverse centre line before bolting to the crankcase. Each initial casting comprises three cylinders from each of the twin banks. Into each

cylinder barrel is inserted a replaceable wet-type liner of a special cast iron; its top flange rests on top of the cylinder block and is pressed down by the cylinder cover. The water jackets are amply dimensioned, and at the top are formed into the usual Sulzer syphon arrangement to give an adequate flow of cooling water against the hottest part of the liner. At the bottom the liner has a triple-ring expansion joint.

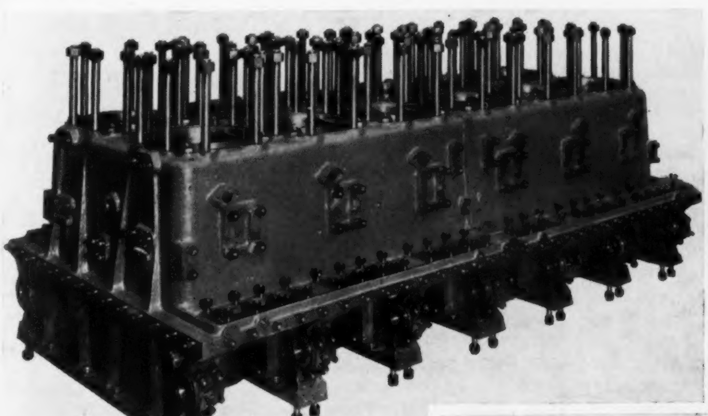
The cylinder heads are individual iron castings and have cored passages arranged in a manner to provide thorough cooling of the valves and injection nozzle. The arrangement of the head is unusual for a railway-type oil engine with cylinders over a foot in diameter in that only one inlet and one exhaust valve are incorporated. The fuel injection nozzle is of Sulzer's own make; it is of the multi-hole pattern and is centrally located in the cylinder head. It opens at a pressure of about 275 kg. per sq. cm. (3,900 lb. per sq. in.). Fuel is injected by individual Bosch pumps for each cylinder. As these pumps are located against their own cylinders the fuel pipes are very short and are all of the same length, so that it is very easy to adjust the maximum pressures in each cylinder to equal values. If a fuel pipe to a cylinder should break the corresponding pump can be put out of action without stopping the engine. Both valves and pumps are operated from gear-driven nickel steel camshafts, one on the outside of each cylinder bank, supported in seven two-piece bronze bearings fixed to the cylinder block and easily accessible through the main covers in the side of the crankcase. All the cams are rigidly keyed to the shaft and those for the fuel pumps are drilled to fix exactly in position in accordance with test results. From the cams the motion is transmitted to the valves through push rods with a ball end piece at the bottom, and having a dashpot mechanism, to rocker arms supported in bronze bearings and having double springs encircling the valve tappets. Unlike the French-built engines installed in the ex-P.L.M. locomotive, the push rods are not encased in steel tubes.

The crankshaft is made of the usual Sulzer brand of carbon steel and is rigidly bolted through a flange at one end to the shaft carrying the primary wheel of the step-up gear. At the other end of the shaft is a dynamic vibration damper which has proved effective in countering all criticals between the maximum and minimum working speeds. The principle of this damper is that of opposing the force causing vibration by a periodically-varying couple generated by a pendulum, which turns with the vibrating system and is suitably tuned to the vibrations to be damped. In essence, the damper consists of an arm keyed to the crankshaft, and at the end of this arm is the fulcrum of a pendulum which can oscillate freely without any other controlling force than the centrifugal force. The arm being subject to the vibrations of the crankshaft takes part in the forced oscillations of the pendulum. In practice, it is impossible to use but a single pendulum, owing to space considerations, and a number of small pendulums are used to give the same effect.

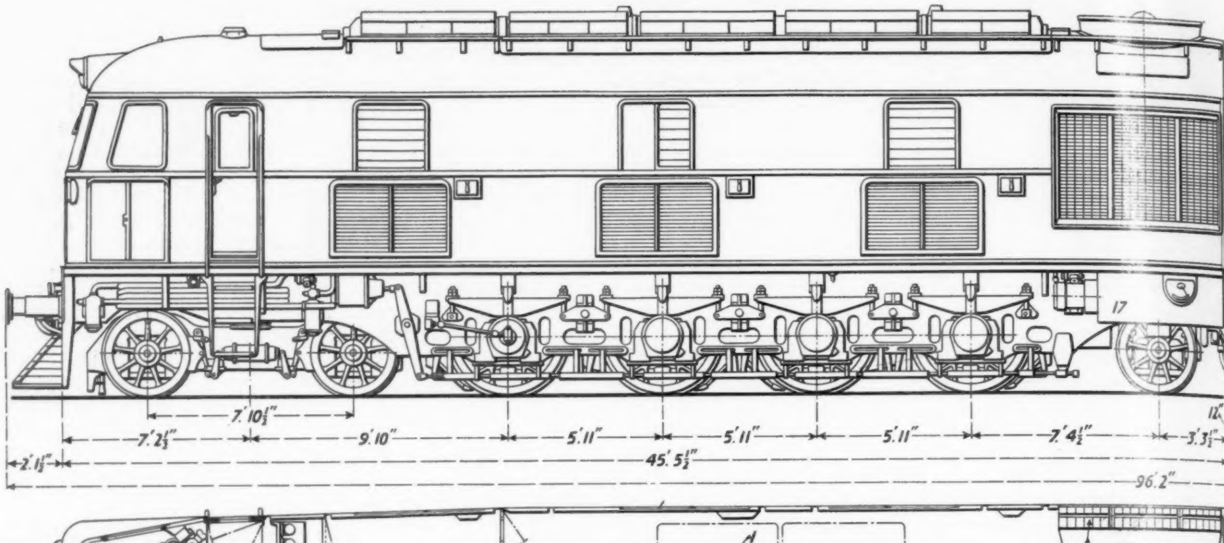
Each crankshaft has seven main bearings having steel shells with whitemetal linings over the whole surface, but the big-end bearings have a whitemetal lining on a bronze shell. The crankshaft is hollow-bored in both shaft and pins, and there are a number of drilled passages through which the lubricating oil is led to the crankpins. The connecting rods are I-section nickel-chrome steel forgings with four-bolt big ends; a hole is drilled up the centre of the rod for the forced lubrication of the hollow casehardened steel gudgeon pin which turns in the rod and is fixed in the piston. The pistons themselves are of forged aluminium alloy and weigh about 45 kg. (100 lb.) each; they carry five pressure and two scraper rings.

Fuel is stored in welded steel main tanks, item 13 in the general arrangement drawings reproduced across the centre pages of this Supplement, which are located in the generator compartment against the driving cabin bulkhead. To the tank are welded seatings for the switch panel framework, auxiliary apparatus, and other details. Each tank has a capacity of 4,000 litres (880 gal.) and fuel is pumped from it to a small service tank, located above the level of the engine against the partition separating the engine room and generator compartment. The transfer pump is mounted on the bearing shield of the main generator and is driven from the main generator shaft.

Lubrication of the engine is ensured by two engine-driven gear wheel pumps within the crankcase; the drive is through a gear keyed to the crankshaft adjacent to the vibration damper. The system operates at a nominal pressure of $2\frac{1}{2}$ kg. per sq. cm. (35 lb. per sq. in.). One pump draws the lubricating oil from the collecting tank 18 between the locomotive frames, and delivers it through a filter into the forced lubrication system; the pressure at the entrance to the filter under full load at full speed

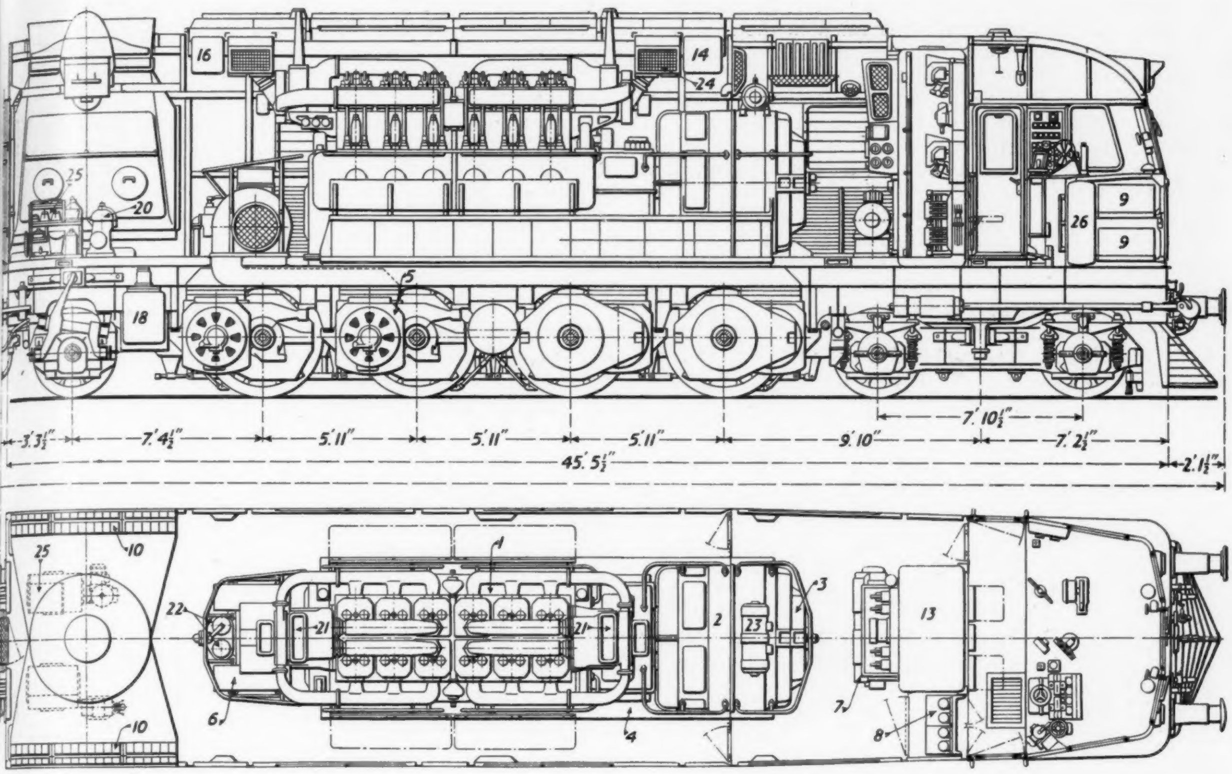


Cylinder block, crankcase, and one crankshaft of the Sulzer engine

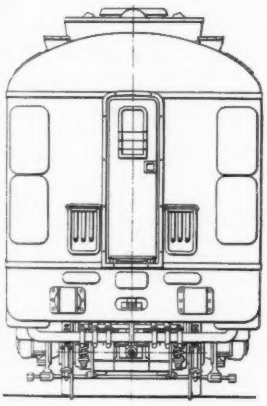


is 1·85 to 1·9 kg. per sq. cm. (26½ to 27 lb. per sq. in.). Under similar conditions the pressure at the entry to the main bearings is about 3 kg. per sq. cm. (43 lb. per sq. in.). The hot used lubricating oil returns to the sump, which, because of the electric traction motors just below the engine, is very shallow. From the sump it is withdrawn by the second pump and passed to the oil cooling elements of the main cooler mounted on the cab sides, whence it flows back to the tank. After a lengthy period of rest, the lubricating oil is forced into all parts of the engine by means of an electrically-driven gear-wheel pump, the motor of which receives current from the main battery. In operation the lubricating oil of each engine is cleaned continuously in an electrically-driven Rameshohl & Schmidt centrifuge, 20, located beneath the radiator air ducts. The centrifuge has a capacity of 300 litres (66 gal.) an hour, and the motor of the group starts as soon as the auxiliary generator is working. In addition there is a double barrelled lubricating oil filter installed adjacent to the traction motor blower group.

All the servo-motor pressure-oil systems, such as the governors, pressure-charging protective device, and field regulator, are connected to the oil cooling circuit. The sump is connected by a compensating pipe to the oil tank lying at a lower level; if there is a leakage of oil at any point the level of the oil in the sump drops, so that the pump cannot pick up any more oil, and in consequence of the drop in oil pressure the governor stops the engine. This oil pressure contact is fitted in the forced lubrication circuit so that there is sufficient provision against the fall of pressure in both circuits. The flyweights of the governor influence the fuel regulation through an oil-pressure servo-motor. When the oil pressure fails the fuel regulating rods are brought back by a spring to the zero position. Two air-operated pistons are connected to the governor link mechanism; one of these serves to reduce the fuel admission at starting and the other is used for stopping. The latter is designed in such a way that when compressed air is admitted it allows the regulating link mechanism to be completely free, but when there is



Elevations, plan, and cross sections of the 2-Do-1+1-Do-2 4,400 b.h.p. diesel-electric locomotive supplied by Sulzer Bros., Winterthur, to the Roumanian State Railways



1 Main engine
2 Main generator
3 Auxiliary generator
4 Engine-generator underbed
5 Electric traction motors
6 Traction motor blower group
7 Air brake motor-driven compressor
8 Main circuit electric apparatus
9 Battery
10 Water and oil coolers
11 Radiator fan
12 Radiator fan motor
13 Main fuel tank
14 Fuel service tank
15 Main water tank
16 Auxiliary water tank
17 Cooling water pump and motor
18 Lubricating oil tank
19 Auxiliary pump for lub. oil circuit
20 Lubricating oil cleaner
21 Büchi supercharger
22 Lubricating oil filter
23 Voltage transformer set
24 Air filter
25 Tool chest
26 Control air reservoir

no compressed air the engine is stopped. This precaution is necessary mainly because of the other protective devices, which must not be ineffective at a moment of danger in consequence of a lack of compressed air. Contacts in the control circuit of the electro-pneumatic starting and stopping valve, and influenced by the oil and water pressures, stop the engine whenever the pressure of the cooling water or of the lubricating oil has fallen below a certain figure, in the case of the oil about 0·8 to 1 kg. per sq. cm. (11½ to 14 lb. per sq. in.). In the same control circuit are also two switches which break the circuit if the temperature of the cooling water or of the lubricating oil should exceed a certain predetermined value. This safety device therefore causes the engine to be stopped when the cooler fan is running too slowly or not at all, or when the thermostats, which short-circuit the coolers at low water and oil temperatures, do not function properly.

The engine cooling water is itself cooled in large gilled tube radiators made by the Suddeutsche Kühler Fabrik A.G. and mounted on the cab sides at the inner end of each half locomotive unit. Just below these radiators, and outside the frames, are the main water tanks, and they are equipped with conveniently-placed water-level indicators. There are four 600-litre (132-gal.) tanks on the locomotive. The cooling water pumps, 17 in the general arrangement drawing, are electrically driven and are carried on the locomotive frames right against the water tanks. The radiator fans are located in the roof and are driven directly by vertical electric motors just beneath them. These motors have a normal capacity of about 17 h.p. The air is drawn in at the sides, passed between the gilled tubes and through ducts, and expelled through the roof.

Supercharging

Combustion air is introduced at the sides of the locomotive and is led to a suction box containing air filters, item 24, of such a size that the suction air speed is as low

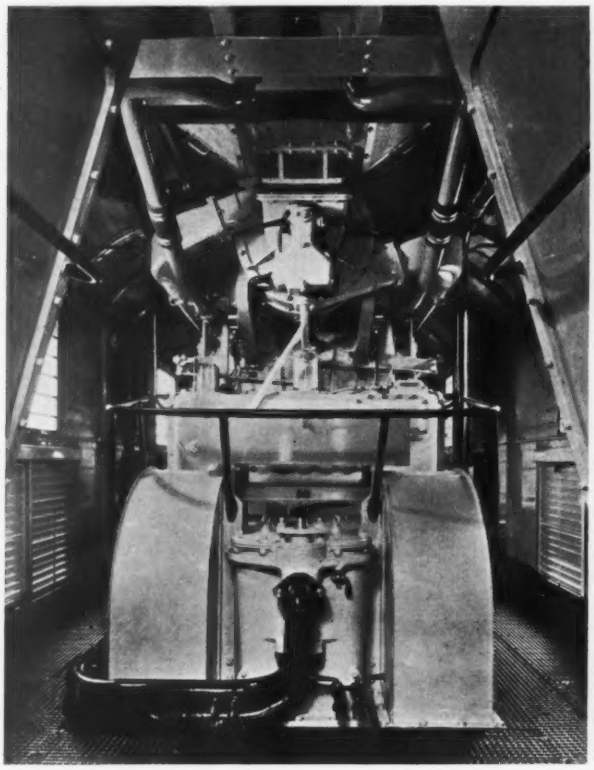
as practicable, giving a good cleaning effect and a reduction in noise. The suction box is fitted to the roof and is connected to the suction branch of the supercharger by leather bellows.

Each engine is fitted with two Büchi exhaust-gas turbo supercharging sets mounted on brackets at opposite ends of the engine. Each set supplies combustion and scavenging air to the adjacent three cylinders in each bank, and the corresponding exhaust turbine is fed from the same group of cylinders. In its simplest form the Büchi supercharger is a single-stage turbine driven by the engine exhaust gases and mounted on the same shaft as the blower wheel, which it drives, and which forces air into the cylinder at a pressure above atmospheric. In the turbine the expansion of the exhaust gases is carried a stage further, and the heat and pressure energy which would otherwise be lost are used to provide an increased air charge to the cylinder, as well as to scavenge the cylinder thoroughly with cool air.

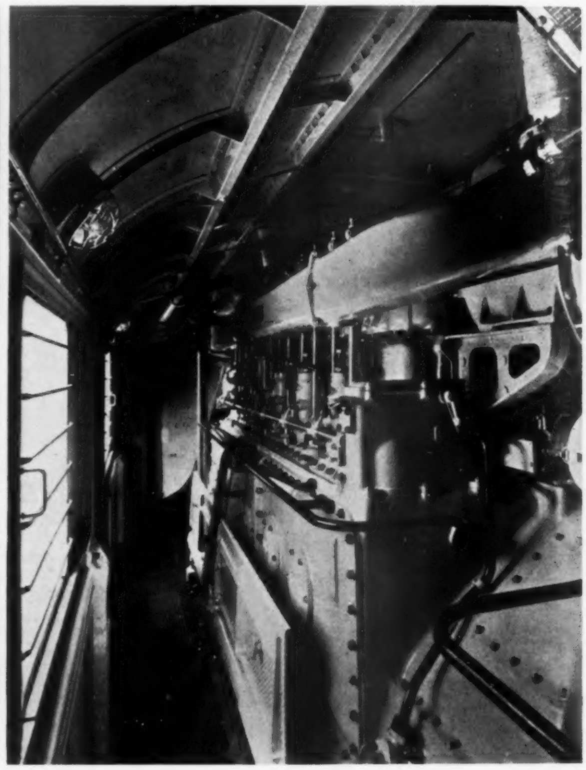
Because of the rather low relative efficiencies of an exhaust-gas turbine and the centrifugal blower driven by it for a given supercharging pressure, approximately the same exhaust-gas pressure as blower pressure is necessary to drive the set with the given temperature of the exhaust. Consequently a pronounced pressure difference between charging air and exhaust gases, which is required for effective scavenging of the working cylinders, is not available. To overcome this pressure condition, the Büchi supercharging system makes use of a device which controls to any desired extent the pressure drop required between the supercharging pressure and the exhaust-gas pressure ahead of the turbine. This pressure drop is effected by strong pressure fluctuations created artificially in the piping between the engine and the turbine, by means of a suitable choice of the cross sections for the turbine and of the volume and cross sections of the exhaust piping. Their occurrence at the correct moment and their correct repetition in each working cycle are ensured by a suitable adjustment of the engine exhaust valve events. There is a certain valve overlap during which both the inlet and exhaust valves of the cylinder are open, and thus efficient scavenging and a cool engine are obtained.

The Büchi supercharging sets fitted to the new Sulzer engines weigh about 1,000 lb. each; that is, for an increase of 5 per cent. in the weight an increase of over 50 per cent. in the output has been obtained, and without any necessity for enlarging the radiator size. With the engines giving an output of 1,900 b.h.p. at 625 r.p.m. the speed of the supercharging blower is about 12,500 r.p.m. and the temperature at the turbine entrance about 930 deg. Fah.; the air quantity then delivered by the two sets to one engine is approximately 320,000 cu. ft. an hour and the charging pressure about $4\frac{1}{4}$ lb. per sq. in. The turbine wheel and blower impeller of each group are mounted on a common shaft which is supported at both ends on roller bearings; one of these bearings can move longitudinally to prevent any stressing through temperature changes. The bearings are lubricated by means of a screw pump driven direct from the blower end of the shaft. The pump is fitted with an oil container fixed to the suction branch of the blower, and this container has a thermometer so that the temperature of the oil can be checked easily.

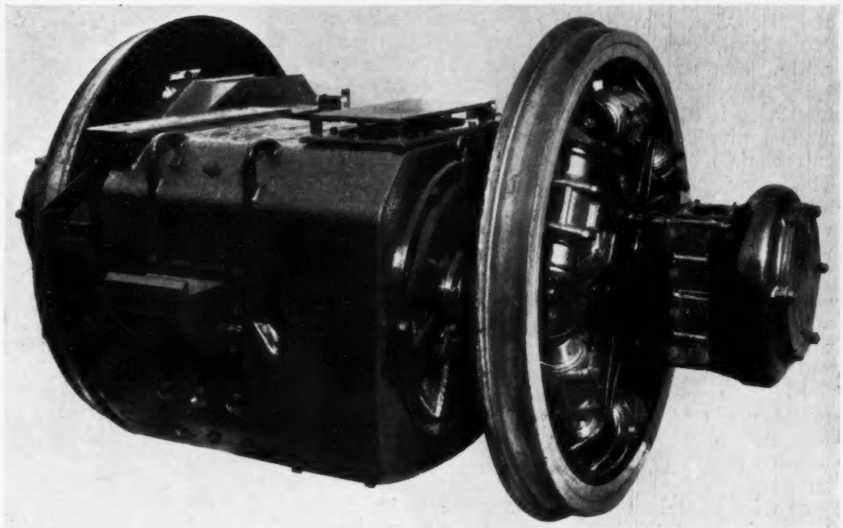
The casing and suction branch of the blower are made



View of engine room from centre of locomotive, showing in foreground the twin lubricating-oil filter and the traction motor blower set. Above and behind are the Büchi supercharger and the engine



View of engine room from side of generator, showing, at the right bottom, the step-up gears, and the engine with the air delivery duct from the supercharger and in the background the air delivery ducts



390 h.p. d.c. springborne traction motor with wheel and individual axle drive assembly as fitted to each of the eight driving axles of the Roumanian State Railways' diesel locomotive. The wheels have a diameter of 53 in. The axleboxes are of the Isothermos pattern

of aluminium alloy, and the casing of the turbine is of a special cast iron, and is water-cooled, the water being taken from the engine circulating system. After passing through the turbine casing the water is led away to a branch where it is joined by the cooling water outlet from the engine cylinder heads, so that the turbine cooling system is really a shunt from the main cooling circuit. After leaving the turbine the low pressure exhaust gases pass though the outlet branch, which is cast in one piece with the inlet, and thence through a short funnel in the locomotive roof to the atmosphere. On each engine are mounted gauges showing the charging pressure of the two Büchi groups, and in the generator compartment is a disc-type thermometer showing the exhaust temperature, and by the use of a finger-and-thumb switch below, this is made to indicate the exhaust temperature cylinder by cylinder, and is thus an additional check upon the working of the engine.

The fuel regulation linkage is arranged in such a way as to form a closed system for driving each group of six cylinders connected to the same supercharging set. This system is influenced on one hand by the governor, through a spring member, and on the other hand by a device controlled by the charging pressure, acting through a stop. As long as the air charging pressure does not drop below the figure permissible for the load prevailing at the moment, the supercharging safety device keeps the stop released, and the speed to which the governor is set by means of the governor spring adjustment is kept constant by the fuel regulation. But if the charging pressure should fall through any defect, the supercharger protector causes the quantity of fuel injected into the cylinders governed by that supercharger to be reduced to correspond with the actual pressure obtaining. The spring member between the governor and the fuel regulating rods then yields, and thereafter the governor acts only on the fuel pumps of the group that is not being supplied by the defective supercharger. If both supercharger protective devices were to come into operation the governor would keep the load on the engine constant at a value corresponding to the reduced quantity of fuel as limited by the protector, and this is carried out with the help of the resistance regulator in the field circuit of the main generator.

To assist in easy and reliable identification, and thus assist maintenance work, the various pipe circuits in the locomotive are painted different colours. Cable conduits are yellow; fuel pipes red; lubricating oil pipes brown; water pipes green, and air pipes blue. Above the main step-up gears between the engine and generator are located the control servo-motor working in conjunction with the governor, and also the speed-regulating solenoids.

Transmission

From the two crankshafts the engine torque is transmitted through straight-tooth spur gears with a step-up ratio of 1·2 : 1 to the main generator, the speed of which is thereby raised from the 625 and 700 r.p.m. of the engine to 750 and 840 r.p.m. respectively on the two top governed speeds. The gear wheels are of alloy steel, hardened and ground, and the teeth were cut by Maag from blanks forged and machined at Sulzer's works. The gear shaft bearings have whitemetal linings on steel shells. Lubrication of the gears is by oil circulated from the engine pump.

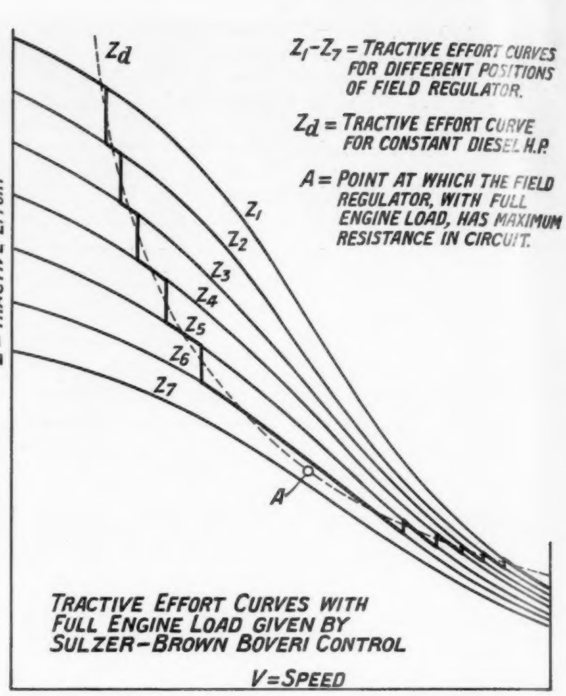
At the output end of the gears the shaft is rigidly coupled to the Brown Boveri main generator. The laminations of the main generator armature are fitted direct on a cast steel hollow member which forms the rotor shaft, and this feature not only saves weight but also gives great rigidity to the rotor system, which is very desirable because of critical speeds. The general design of the locomotive necessitated the generator being kept as short as possible, and to that end the commutator has been put at the engine end and the auxiliary generator inserted almost entirely within the main generator; the armature of the auxiliary generator is shrunk on to the main rotor member. A fan fixed to the main rotor at the driving gear end draws air through the main and auxiliary generators and expels it to the atmosphere through a casing below the floor of the locomotive. This arrangement saves space and has the advantage that carbon dust is removed from the commutator and is immediately discharged to the outside. Moreover, if any sparking occurs round the commutator the strong current of air makes it difficult for an arc to form between the commutator and the winding. The rotor of the main generator is supported by a roller bearing beyond the auxiliary generator and also on the adjacent driving gear bearing. The generator frame is of cast steel, and as a result of step-up gears being used it is located with the armature centre above the engine crankshaft centre, and thus does not project to an inconvenient degree below the floor, nor involves a very wide engine-generator underbed which would encroach upon the passage-ways down each side of the cab.

On the one-hour rating the main generator has a capacity

of 1,250 kW. 505 volts 2,480 amp. at a nominal speed of 744 r.p.m., corresponding to an engine speed of 620 r.p.m. At the same speed the continuous output is 1,250 kW. 615 volts 2,040 amp. The maximum voltage in service is 910, but a tension of 1,200 volts has been applied without harm to the generator. The maximum current rises to a peak of about 4,000 amp. at starting. The capacity of the auxiliary generator is 70 kW., this allowing power for the pumps of the train heating wagon which is hauled in all Roumanian main line trains in cold weather. As a result of this practice no train heating boiler is installed in the locomotive. A capacity of about 60 kW. from the auxiliary generator is enough for full auxiliary load for each half of the locomotive. The continuous rating is 70 kW. 215 volts 325 amp. at 605 to 840 r.p.m.

Although of the single-armature horizontally-located form usually associated with nose-suspended motors, the four Brown Boveri electric traction motors on each half locomotive are rigidly attached to the locomotive frame structure. They are force-ventilated from a motor-blower group installed in the engine room between the end of the engine and the radiators. On the one-hour rating the capacity per motor is 290 kW. 505 volts 620 amp. at 780 r.p.m.; on the continuous rating the output is 295 kW. 615 volts 510 amp. at 1,050 r.p.m. The maximum current is 800 amp. and the maximum normal voltage 910, but on the reception tests a voltage of 1,050 was applied at a motor speed of 2,240 r.p.m., and a voltage of 1,200 has been applied without damage. The drive to the wheels is through a hollow quill individual axle drive of the Westinghouse family. The motor has bearings on the quill and at one side in a welded steel case is a reduction gear with a ratio of 16:89. At the ends of the quill are spiders with dogs driving the wheels through groups of helical springs which bear against the wheel spokes. At the driving end the nickel-chrome steel toothed rim of the gear wheel is shrunk on to the spider of the quill.

In order to simplify the maintenance of the electrical equipment, ball and roller bearings (of the S.K.F. type) have been used in the rotating machinery in preference to the plain type, and wherever possible bearings have been standardised for more than one machine. In the same fashion, there is only one type of carbon brush and holder for the main generators and traction motors, a second type for the larger auxiliary motors, and a third type for all the smaller auxiliary motors.



Form of tractive effort curve given by servo-field regulator control

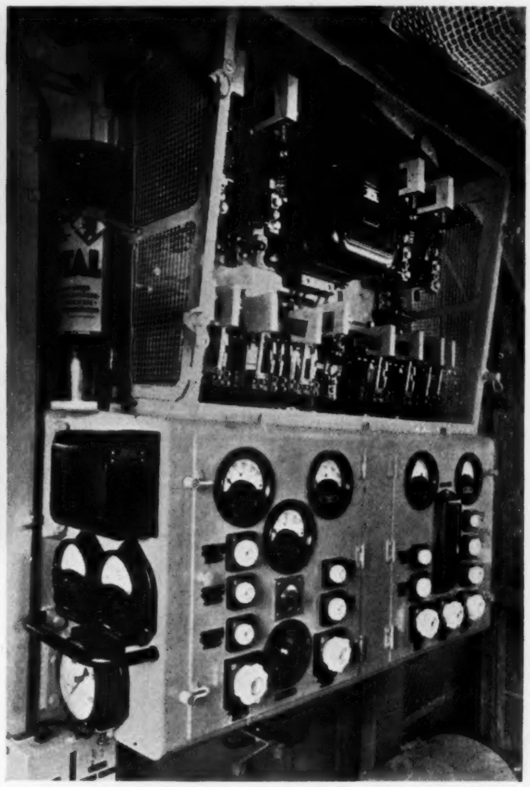
1,250 *kW. main generator and* 70 *kW. auxiliary generator*

A Jungner cadmium-nickel battery is fitted at each end of the locomotive. There is a total of 128 cells and the capacity of each battery is 150 amp.hr. For engine starting the two batteries are connected in parallel and give a maximum instantaneous starting current of about 3,000 amp. The battery current can be switched on or off as the driver enters or leaves the locomotive by a switch, on the driving table, just inside the left-hand door of each driving cabin.

Controls

The system of control embodied is the latest development of the Brown Boveri servo-field regulator type but includes Sulzer's form of servo-motor and governor rheostat regulation of the engine output. The field regulator under oil pressure which governs the separate field of the main generator is influenced directly and mechanically by the fuel pump control rod, which itself is controlled by the centrifugal governor of the engine. Through the combined influence of the governor and field regulator a definite engine speed and definite amount of injected fuel are simultaneously maintained at constant values, which means that constant engine output is attained. The engine speed and the requisite torque can be set or modified by the driver manipulating his controls. The control incorporated permits of engine operation at four speeds, viz., 380, 485, 625 and 700 r.p.m., and also gives eight controller notches, four of which give variable torque characteristics at a given engine speed.

The generator characteristics which prevent overloading of the engine are obtained by a triple system of excitation,

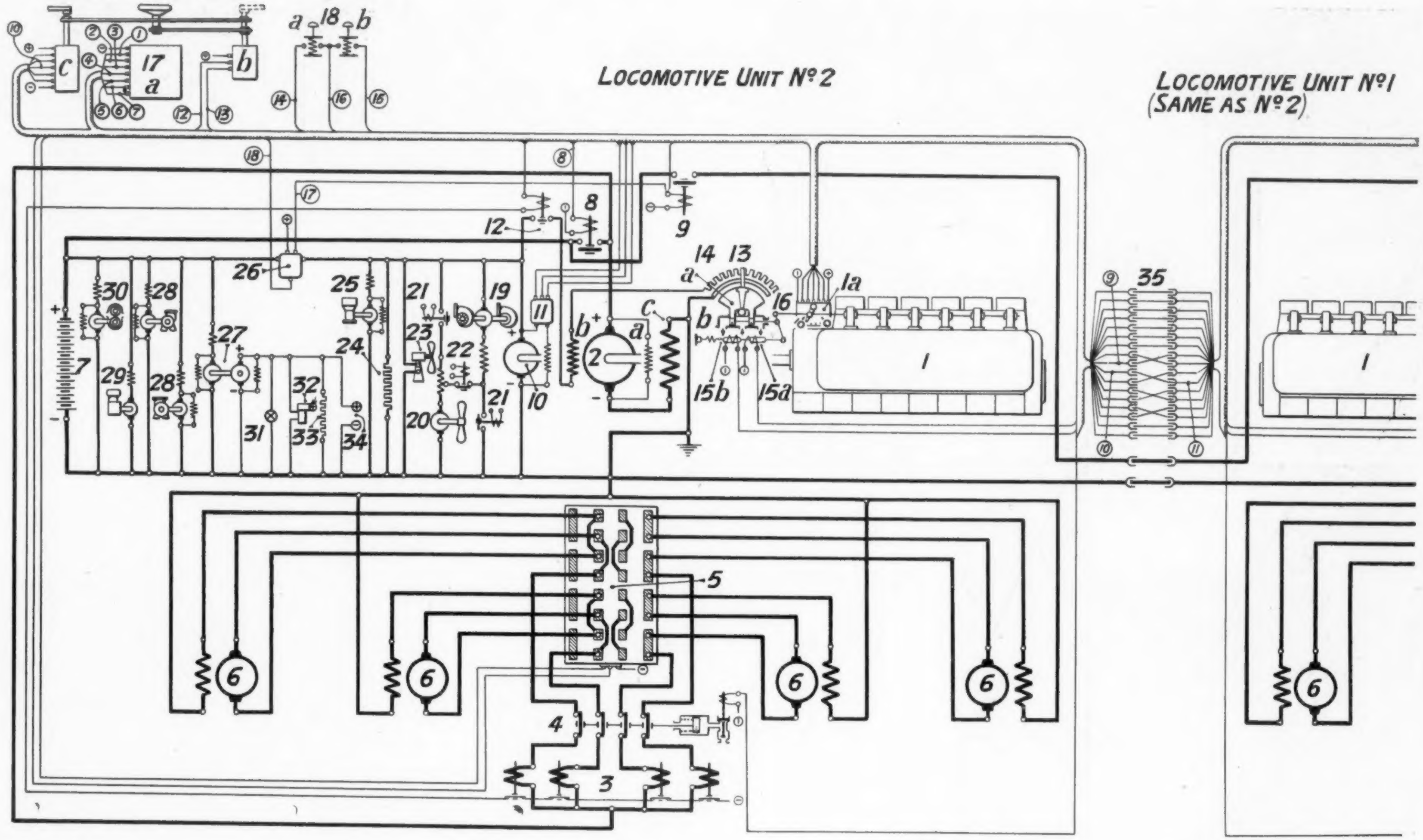


***Above:* Driving controls and apparatus, including (right to left) Westinghouse automatic brake handle, regulating and sanding brake handles with Teloc speed recorder above, controller handle, engine starting switches, rev. counters, and meters, and (left) the ventilating fan**

***Right:* Auxiliary apparatus and control panels mounted against main fuel tank**

the generator fields being under the action of: *a* an unregulated shunt winding; *b* a regulated separately-excited winding fed from the auxiliary generator; and *c* a counter-compound winding through which flows current from the rotor. The different windings bear such a relation to each other that when the separate excitation is switched off the voltage falls to zero. With full separate excitation when the vehicle is at rest, the exact maximum permissible tractive effort exists at the wheel rims. That is, in the high and medium current ranges of the generator characteristics the curve is influenced by strong separate excitation, whereas in the high voltage range the slopes of the

Roumanian locomotive hauling trial train of passenger stock between Winterthur and St. Gallen, Switzerland



1 Diesel engine
1a Engine governor
2 Main generator
2a Unregulated shunt winding
2b Regulated separately-excited winding
2c Counter-compound winding
3 Maximum current relay
4 Electro-pneumatic motor disconnecting contactor
5 Reverser
6 Traction motors
7 Battery
8 Starting contactor
9 Battery paralleling contactor
10 Auxiliary generator
11 Voltage regulator for auxiliary generato
12 Exciter contactor
13 Field regulator resistance
14 Field regulator
14a Rotary piston
14b Slide valve
15a, 15b Magnets for torque control
16 Control lever assembly
17 Main controller
17a Main drum
17b Reversing drum
17c Starting drum
18a, 18b Engine stopping buttons
19 Traction motor blower groups
20 Radiator fan group
21 Contactors for paralleling 19 and 20
22 Contactor for connecting 19 and 20 in series
23 Driving cabin fan
24 Driving cabin heater
25 Oil separator group
26 Battery charging apparatus
27 Voltage transformer
28 Cooling water pump and motor
29 Air brake compressor and motor
30 Oil pump group
31 Lighting switch
32 Window wiper
33 Window heater
34 Control
35 Inter-loco cable connections

curves change owing to the increasing effect of the self-excitation.

The general shape of the speed-tractive effort curve given by the servo-field regulator control is shown in one of the accompanying diagrams. In this drawing the tractive effort curves Z_1 to Z_7 are plotted as a function of the speed of the vehicle for constant separate excitation. The dotted hyperbolic line *Zd* corresponds to constant engine output over the whole speed range. Within a certain range of vehicle speed the output is kept approximately constant by the combined action of the three systems of excitation. If the output has to remain constant from the speed at which the normal output of the engine is reached with maximum tractive effort, until approximately maximum speed, some regulation of the excitation is necessary. This is arranged in such a way as to give the thick black zig-zag line shown in the diagram.

Referring now to the full-page wiring diagram, if the oil engine is running at full load after the train has been accelerated so that the pointer of the diesel governor *1a* is in the position shown, the slide-valve *14b* of the oil-pressure servo motor is in the closed position and the torque magnets *15a* and *15b* are also in the positions as drawn. The rotary piston *14a* is thus at rest and that part of the resistance *13* which is switched in is not

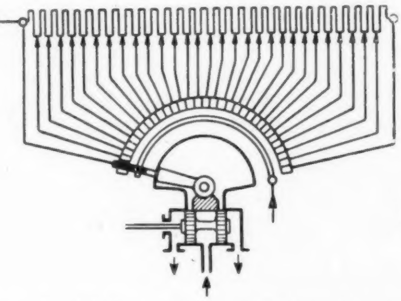


Diagram showing fundamental construction of the servo field regulator

changed. If the tractive resistance increases, say as the result of the train coming on to a gradient, the tractive effort being exerted is no longer sufficient to maintain the speed; the train slows down, and the tractive effort changes, moving along one of the lines Z_1 to Z_7, where these concide with the zig-zag line. If the original operating position was to the right of the point *A*, as shown in the tractive effort form diagram, the engine is overloaded and the pointer *1a* moves towards position *10*. The turning of the governor pointer causes the slide valve *14b* to move towards the left, and allows oil under pressure to enter on the left side of the rotary piston *14a*. This piston then turns towards the right, and the regulating switch fixed to it switches in a further part of the resistance *13* and the working is transferred to a lower *Z* number. However, the action of the servo motor does not end until the tractive effort reaches the next *Z* curve where it cuts the *Zd* line, that is, when full load conditions are attained once more. On the other hand, if there is a reduction of load, the governor pointer moves in the direction of *O* and the slide valve *14b* goes to the right. The piston *14a* is thus turned to the left and the excitation of the generator is thereby increased until full load has once more been established.

In normal service it is neither necessary nor desirable that the engine should be worked at full load all the time. Therefore the drum of the main controller, *17a*, has a number of steps running at reduced output as well as a step for full load. The output is regulated partly by adjusting the engine speed to different values which are then kept constant and partly by adjusting the fulcrum of the lever *16*, which is done by the magnets *15a* and *15b*. The running steps 1-4 of the controller insert resistances into the separately-excited winding *b* of the main generator so that a uniform graduation of the starting tractive effort is obtained when the locomotive is starting from rest.

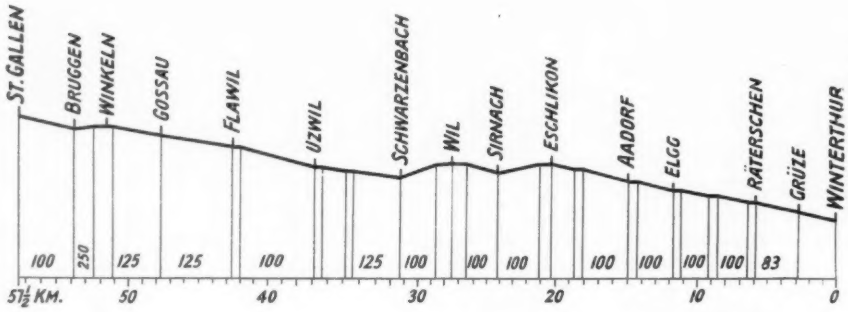
In the position shown in the main wiring diagram, the armature of the magnet *15b* is drawn up against the action of the tension spring and the lowest point of the lever *16* is pressed into the extreme right position. At this point the closing position of the valve *14b* corresponds to the maximum fuel injection as set by the governor *1a*. But if the magnet *15a* is excited, the lowest fulcrum of lever *16* moves towards the left, and as the centre fulcrum of this lever remains stationary the governor adjusts the quantity of fuel to a smaller amount. If neither magnet is excited the lowest fulcrum of lever *16* goes towards the extreme left, and the governor maintains the smallest load at a constant value.

Torque magnets *15a* and *15b*, and also the valves for adjusting the speed, are controlled from the main drum of the controller, *17a*, and the rotational speeds and the torques are co-ordinated in the different controller steps, as indicated in the attached table. The tractive effort is thus graduated uniformly over the whole range of track speed.

Controller Step	Torque	Speed	B.H.P.
1.	Variable	$n_1 = 380$	Variable
2.	,,	$n_1 = 380$	,,
3.	,,	$n_1 = 380$	,,
4.	,,	$n_2 = 485$	,,
5.	M_1	$n_2 = 485$	1,300
6.	M_1	$n_3 = 625$	1,600
7.	M_2	$n_3 = 625$	1,900
8.	M_3	$n_4 = 700$	2,200

Switches *9* put the positive poles of the batteries *7* in parallel, and are closed when the two engines are at rest; the negative poles are permanently connected together. When the starting contactors *8* of the two halves of the locomotive are switched on alternately, the circuit is closed from the batteries, now in parallel, through the rotors of the respective generators and their series fields *2c*. The generator then acts as a series motor to start the engine. The main generators *2* feed the traction motors *6* through the overload relays *3*, the traction motor contactors *4*, and the reverser *5*. The reverser is operated with the help of the reversing drum *b* of the controller *17* and of the leads *12* and *13*.

Drum *c* of the controller *17* serves for starting the two main engines, the front starting contactor *8* being switched in by means of the lead *8*, and the rear starting contactor *8* by means of the lead *9*. The leads *8* and *9* are consequently crossed in the control circuit coupling *35*. Further, with the help of the starting drum *17c*, the operating circuit of the charging apparatus *26* is interrupted in the starting position. The operating circuit of the starting apparatus leads from the positive pole of the control current source through the charging apparatus *26*, lead *18*, starting drum *17c*, lead *10*, coupling *35*, lead *11*, and starting drum *17c* of the other driver's cab to the negative pole of the control current source. Consequently, when starting either of the two engines, both sets of charging apparatus *26* are open. It is therefore not possible for one auxiliary generator to furnish current for the starting of the other diesel-generator set. With the charging apparatus open, lead *17* is connected to the positive pole by means of an auxiliary contact. The contactors *9* are therefore closed and the two battery halves are connected in parallel for starting the engines; an interlocking device



Profile of the Winterthur-St. Gallen line of the Swiss Federal Railways over which the Roumanian diesel locomotive was tried with a trailing load of 300 tons. Including certain slacks, the start-to-stop times averaged 21¼ min. from Winterthur to Wil and 23¾ min. thence to St. Gallen. The top speed was 62 m.p.h.

prevents the two engines being started simultaneously. The driving motor contactors *4* and the exciting contactors *12* are switched in by the main drum with the help of leads *6* and *7*. The leads *1*, *2* and *3*, controlled from the same drum, serve on one hand for operating the speed regulating valves of the engine, and on the other hand for actuating a contact apparatus which adjusts the additional resistances in the field of the auxiliary generator in such a way that the voltage remains approximately constant at all speeds. The leads *4* and *5*, finally serve to control the torque magnets *15a* and *15b*. The engine is stopped by actuating the push button switch *18*, which bridges over the solenoid of an electro-pneumatic valve by short circuiting the leads *14* and *16*, or *15* and *16* respectively; the valve then allows air to escape from the stopping cylinder, so that a spring brings the fuel regulating rods to zero filling.

Some of the auxiliary services are directly connected to the battery, and can therefore be worked when the engine is at rest; the others are fed from the auxiliary-generator side of the charging apparatus *26*, in which case they start and stop with the main engine. Among these latter circuits are the fans for the driving motors, for the coolers, and for the driver's table (*19, 20, 23*), and also the oil separator *25*. The motors for the traction motor and cooler fans are switched in series in winter, and also on the first steps of the controller in summer by means of the contactors *22*, and with the upper controller steps in parallel in summer by the contactor *21*. The heating *24* for the driver's cab is connected to the auxiliary generator. At the battery side of the charging apparatus *26* are connected the voltage-transformer group *27*, the cooling-water pump set *28*, the brake compressor *29*, and an oil-pump group *30*, which serves for priming the piping after lengthy periods of rest. On the secondary side of the voltage-transformer group (24 volts) are connected the lighting *31*, window wipers *32*, window heaters *33*, and the control circuits *34*.

The field regulator assembly controls changes in load due to outside circumstances, such as any alteration in the main generator winding temperature. When these windings are heated up the characteristics Z_1 to Z_7 move downwards. This causes less load on the engine and the field governor increases the excitation so that the desired output is once more obtained. The field regulator also gives compensation for alteration in the auxiliary load and always works in such a way that the main engine is never overloaded in spite of any fluctuations there may be in the auxiliary load. Alternatively, if there is a reduced call on the auxiliaries the corresponding amount is switched over to the main traction load. If there is a reduction in the engine output due to bad combustion, or through individual cylinders being out of order, the field regulator at once reduces the load in proportion.

Dead-man control is incorporated, and is operated by a footboard in the driving position. It has a lag of **15** sec. before coming into operation, and at the opposite side of the driving cabin is a push-button, so that if the driver has to move to that side during shunting, he can keep his finger on this button and prevent the brakes being applied. On the completion of the lag period, a warning buzzer is sounded in each cabin, the supply of power is interrupted, and an emergency application of the brake is made. The driver also has a press-button signal for summoning the assistant driver, and this not only gives a sound indication but lights a red lamp above the door of the engine room. Included in the instrument dashboard are r.p.m. and controller notch indicators for each engine, generator ampere meters, and brake air gauges; elsewhere in the cab are a Teloc speed indicator (at one end this is a recording instrument), a Royal electric window wiper, Bosch lighting switches, head-lamp dimmer, and the engine starting and stopping switches.

Test Trips

Trial runs over the Winterthur—St. Gallen line of the Swiss Federal Railways did not extend the locomotive in the least, for the trailing load was only a little over **300** tons, and, as will be seen from the accompanying gradient profile, this line is almost flat compared with the Campina—Brassov route. Without using anything like full power, the train was accelerated from rest over a slightly rising and curved line to **30** km.p.h. in **35** sec., to **40** km.p.h. in **46** sec., to **50** km.p.h. in **58** sec., to **60** km.p.h. in **69** sec., to **70** km.p.h. in **84** sec., to **75** km.p.h. in **91** sec., and to **80** km.p.h. in **98** sec. These values are characteristic of a number of readings taken, and show that a straight-line acceleration was maintained up to about **70** km.p.h. Normal currents at starting (per generator) were **2,000** amp. at **400** volts on the first notch, **2,500** amp. at **400** volts on the second notch, **2,700** amp. at **400** volts on the third notch, dropping to **1,800** amp., and **1,200** amp. at **430** volts on the fourth notch. Running at **80** to **90** km.p.h. up **1** in **125** to **1** in **250** grades took **900-1,000** amp. at **700** to **750** volts. On the uphill sections the fuel consumption averaged **8** gr. per *tonne*-km. (**13** gr. per ton mile), and downhill **4·5** gr. per *tonne*-mile (**7·3** gr. per ton-mile).

Nigerian Railcar Proposals.—A proposal to run a bi- or tri-weekly first and second class diesel-engined buffet railcar on the Nigerian Government Railway for business men is set forth in the Report of the Director of Transport (Nigeria), 1936–37. Leaving Lagos for Ibadan before breakfast (which would be served *en route*), the new service would arrive in time for business to be transacted, and on the return journey would leave during the afternoon (tea served *en route*) and arrive back at Lagos before dinner. The round-trip fare would include both meals served aboard.